Railway Age

AND RAILWAY REVIEW

DAILY EDITION

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MINER

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PROVIDES

MAXIMUM PROTECTION

ELECTRICITY IMPROVES SERVICE AND INCREASES REVENUE

THE
ILLINOIS CENTRAL
electrified to improve suburban operation

The Illinois Central, which serves Chicago's crowded suburban area, carried more than thirty million commuters in 1927—twenty-five per cent more than in 1926.

President L. A. Downs, of the Illinois Central, attributes much of the increased patronage to the faster and more frequent train service provided in the electrified zone.

Complete electrification of terminal lines not only brought about this sudden and substantial increase of riders but also turned the $337,000 operating deficit of 1926 into an income of $530,000 in the following year.

Speed always appeals to commuters; and in addition to speed, riders have been attracted by the absence of smoke, cinders, and noise; by the seating capacity and smooth motion of the trains; and by the clean comfort of the cars.

Not only at terminals, but on the long, level stretches of main line, electric operation produces more revenue, simplifies operation, reduces maintenance, and gives better service.

Manifold advantages of electric operation have resulted from the use of electric locomotives and cars on main and branch lines, at terminals, and in suburban traffic; gas-electric cars for light-traffic lines; oil-electric locomotives in freight yards; and gas-electric buses for feeder service. Electric floodlights expedite freight sorting, and electric signal systems promote safe transportation.

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GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

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Laboratory Draft Gear Tests Alone are Insufficient

UNUSUAL interest centered in the progress report of the committee on Couplers and Draft Gears at Monday morning's session, particularly that part of the report by W. E. Gray, in charge of the draft gear tests at Purdue University. Draft gear testing laboratories have been in the past and are now playing a vital part in the development of modern draft gears, but railroad men and manufacturers alike are generally agreed that in the final analysis service performance is what counts, and it is impossible to duplicate service conditions completely in any laboratory. Mr. Gray's statement in the concluding part of his report that "When this series of tests is finished there will be available complete information as to the action of modern draft gears, ... " would seem to require some modification. Moreover, his succeeding statement that "Both the desirable and undesirable characteristics will be known, and this information can be used as a guide in writing specifications for a satisfactory draft gear" is much to be doubted. The procedure to be followed in concluding the Purdue draft gear tests, and subsequent to their conclusion, is distinctly a prerogative of the Committee on Couplers and Draft Gears and, doubtless, further service tests may be planned. Service test data, supplementing information obtained from the laboratory tests, should make possible a determination of draft gear characteristics necessary to meet modern operating conditions.

The Railroads and Aviation Expansion

INCLUDED in the exhibit this year for the first time is a radial, nine-cylinder, air-cooled aeroplane motor and several propellers. Perhaps these exhibits may seem foreign to an exhibit of railway equipment. The crowds that have gathered about the motor exhibit, however, indicate the interest that has been aroused in this form of transportation since Colonel Lindbergh's epoch-making flight to Paris a year ago. Furthermore, an observer on the side lines, listening to the comments made by the railroad men viewing the exhibit, fully appreciates the fact that these men have already recognized aviation as a form of transportation rather than merely a thrilling amusement. The formation of the Transcontinental Air Transport, Inc., to furnish 48-hour rail and aeroplane service between New York and California, indicates that the railroads are alive to the possibilities of aviation. In addition, the Motor Transport Division of the A. R. A. has suggested to the president of the A. R. A. that a committee be appointed to deal with the question of aviation. These activities indicate that future years will see the railroads taking an active part in the development and stabilization of aviation as a dependable, safe and reliable part of our national transportation.

A New Facility Offered to the Railroads

THE handling of double loads, such as is quite often necessary in the transportation of unusually long steel shapes, either mill stock or fabricated, and lumber has always presented a difficult operating problem. It was with the idea of contributing to the elimination of some of the difficulties and of effecting a reduction in shipping coasts that the Carnegie Steel Company has offered for long-haul service the 65-ft. gondola car being shown among the track exhibits. This car was originally designed to serve merely as a plant facility in the transportation of steel during the rebuilding of the structural mills at the Homestead Steel Works. The savings effected during the two years of initial operation with these cars were sufficiently impressive to lead to an investigation as to the possibilities of a car of that type in long-haul service. The estimated cost of the 65-ft. car is slightly over 50 per cent of the cost of two ordinary gondola cars. Maintenance and depreciation on one of the longer cars would, of course, be considerably less than the same charges against two of the mill type cars now used for making double loads. The saving in track space of 30 per cent would contribute to

some increase in yard capacity and to a decrease in train length. Another advantage would be the reduction of train resistance by the elimination of the friction set up by the sliders, used in double loading, when negotiating curves. This car represents a type of facility developed for a special class of service and is of interest to mechanical officers for the reason that its use may offer a possible source of economies to the transportation department. Cars of this type have made in excess of 12,000 miles in trunk line service and, while there are minor constructional details that it will be desirable to alter, the experience of the roads to date indicates that the basic design is adaptable to long-haul service and that the objectionable features can be eliminated in future construction. A preliminary consideration of the advantages of this type of car indicates potential savings to shippers of sufficient importance to warrant the interest of both the mechanical and traffic departments.

Cinder Pit—The Bottle Neck at Terminals

THE cinder pit is admittedly the "bottle neck" of many locomotive terminals. Preference is evidently given in the committee's report this year to the water-type pit, which has several advantages, the most important being doubtless its large storage capacity. There is much to be said in favor of the multi-track mechanical cinder plant, however, which is now available in several reliable types, and generally lends itself to more flexible operation in that locomotives coming in on several tracks have their fires dumped and move directly to the enginehouse or ready track without delay. The multi-track mechanical cinder plant can be arranged to serve as many parallel tracks as desired and has apparently demonstrated both its dependability and economy. For example, a large eastern road recently contracted for the installation of two three-track mechanical cinder plants to be installed at its newest locomotive terminal for a total expenditure of less than $25,000. Two years previously, this same road spent over $80,000 for a two-track deep-water cinder pit at another terminal then under construction. Six locomotives can be decindered simultaneously on the two mechanical units, whereas the deep water pit does not accommodate more than four locomotives at one time. In addition, the fire knockers can work with safety on both sides of every locomotive, which is not usually possible with water pits. The trend in terminal design is strongly in the direction of mechanical cinder plants, which are reported installed at 20 out of a total of about 22 terminals built new or reconstructed during the past 18 months.

Locomotive and Car Lighting Developments

CHAIRMAN G. E. Smart performed particularly good work yesterday in directing the discussion of the report on locomotive and car lighting. He raised numerous pertinent questions concerning recent reported developments in locomotive train lighting. There was nothing perfunctory about the discussion and rather than dealing with details of specifications it was concerned with the performance of different kinds of car lighting equipment. Representatives of many roads presented information concerning the use of their own equipment which was both complimentary and critical. A motion was passed to have the next committee report cover the subject of locomotive train lighting and axle generator car lighting on the basis of costs, service and possibilities. This will make the subject of general interest to the members of the Mechanical Division representing the car departments of the railroads. The affiliation of the A. R. A. committee with the car lighting committee of the Association of Railway Electrical Engineers insures that the A. R. A. report will include important details and that the necessary electrical engineering work will not be overlooked. Probably the greatest difficulty the committee will encounter in its work during the ensuing year will be to establish a basis for compiling costs, which include all of the items involved and on which results from different sources can be compared. A somewhat similar standard should be established for measuring dependability and excellence of service. Consideration of possibilities might well include electricity for refrigeration, cooking, devices for convenience of passengers, operation of some locomotive auxiliaries, etc. Lighting of rail motor cars and trailers should not be overlooked in this contemplated car lighting study.

Why Build Heavy Motor Rail Cars?

REGARDLESS of the fact that the trend in passenger car design during the last 20 years has been toward heavier cars, there has recently been a demand for lighter construction. That the requirements of strength and safety may be met satisfactorily in lighter weight construction has been demonstrated in several instances by recent developments in suburban passenger coaches. With the introduction of the motor rail car in its present state of development, the manufacturers, possibly recognizing the limitations of power plant capacity, did not allow themselves to be too greatly influenced by traditional designs and set out to develop the lightest weight car body, consistent with strength and safety, particularly in motor rail car service.

Any reduction in weight for a given load means a reduction in ton-miles and there are several distinct advantages to be gained by building lighter units. Among these might be mentioned more rapid acceleration, which alone results in the increased ability to maintain schedules, plus the ability occasionally to handle increased trailing loads. Another advantage, and a most important one, is that of the possibility of reduced fuel costs attributable directly to a lighter train. Of the operating charges alone, the item of fuel constitutes about 20 per cent of the expense of motor rail car operation, exclusive of any fixed charges. Based on estimates involving present designs in service, it is believed possible to save at least five per cent of the present fuel costs by a consistent reduction in weight, which would, of course, amount to approximately one per cent on the basis of total operating expense.

Aside from the initial saving due to the introduction of motor rail car operation, any possible operating savings

must be made in the items of fuel or maintenance, and any reduction in weight would directly affect these two items.

Another factor which a railroad should consider is the possible saving in initial cost. Some early motor rail car designs which met all of the requirements of the United States postal service for buffing stresses have demonstrated the possession of the necessary elements of strength and safety.

There has been an increasing tendency on the part of the railroads to request the construction of motor rail car bodies to the railroad company specifications. In this tendency the influence of heavy passenger car design is evident.

Some recent cars built to railroad specifications have shown an increase in initial cost, for the car body alone, of approximately 12 per cent, as compared with some of the earlier cars. Modern car construction has reached the point where it is an engineering possibility to design bodies for motor rail car service without embodying excessive weight. A saving of 12 per cent in initial cost, not to mention the resultant savings in operating cost, are economies which should receive more consideration from mechanical officers.

Brake Shoe Pressures and Wheel Failures

THE Committee on Brakes and Brake Equipment has considered it expedient to include in its report to the Mechanical Division, the report of the Air Brake Association committee appointed to analyze the paper presented by F. K. Vial, vice-president and chief engineer, Griffin Wheel Company, at the 1927 convention of that association. This report was presented and discussed during the last convention of the Air Brake Association at Detroit, Mich., in May. Considering the nature and scope of Mr. Vial's paper, it is no more than proper that his recommendations and those of the Air Brake Association committee be brought before the Mechanical Division for its consideration.

Prior to reading his paper at Washington last year Mr. Vial stated that: "For the last twenty years it has fallen to my lot to gather information and to determine on what conditions a by-product of retardation injures wheels. I had thought that it would be pertinent to bring this information before this association with the idea that perhaps it might be helpful in adjusting certain conditions to minimize damage to wheels and add a little to the factor of safety of transportation and at the same time not interfere with the efficiency of retardation." In closing the discussion following the presentation of Mr. Vial's paper before the Air Brake Association, the chair ruled that the executive committee of the association appoint the author of the paper, together with representatives of the manufacturers and railroads, as a committee to analyze the paper and report at the next convention.

It was also ruled that Mr. Vial be consulted as to the membership of the committee. There were no objections to this ruling from the floor.

Mr. Vial in his introductory remarks stated quite clearly the object of his paper. The fact that he was presenting data and figures collected during a period of twenty years for the primary purpose of enlisting the cooperation of all those concerned, was evident to all those present at the Washington convention. That, undoubtedly, was the reason for the president of the association making the ruling he did at that time.

At Detroit, last month, in the discussion of the report of the committee appointed to analyze his paper, Mr. Vial stated that he had been placed on trial but had not been given any opportunity to defend himself. Neither Mr. Vial nor any other representative of the wheel manufacturers was appointed to serve on the committee; neither was he consulted while his report was being analyzed.

Perhaps the same conclusions arrived at by the Air Brake Association committee would have been made by a committee which also included Mr. Vial and other representatives of the wheel manufacturers. Much of the argument contained in the report should have been thrashed out and settled in the committee room instead of being brought to the convention floor. That would have been the result had all parties to the question been represented on the committee. As the matter now stands, there is still a dissatisfied party and the argument will probably continue.

The third recommendation of the report to the Mechanical Division of its Committee on Brake and Brake Equipment is excellent and, if carried out, should be of real assistance in the solution of the problem. Analysis of the data leading to the first and second recommendations, however, should be made during the ensuing year, to give Mr. Vial and any of the other wheel manufacturers who may desire to take part; an opportunity to work with the committee in considering the problem of wheel failures.

Today's Program

THE fifth session of the Mechanical Division convention will be called to order in the Greek Temple on the Million Dollar Pier at 9.30 a. m., daylight saving time, and will adjourn at 12.30 p. m. The program follows:

Mechanical Division

Discussion of Reports on:
- Arbitration Committee.
- Committee on Prices for Labor and Materials.
- Specifications and Tests for Materials.
- Loading Rules.
- Tank Cars.
- Wheels.

Entertainment

10:30 a. m.—Orchestral Concert in Entrance Hall on the Million Dollar Pier.

3:30 p. m.—Orchestral Concert and Impromptu Dancing in Entrance Hall, Million Dollar Pier. Vocal numbers by Howard J. Melaney, the Singing Fireman of the Yellowstone Division of the Northern Pacific.

9:30 p. m.—Grand Ball in the Ball Room on the Million Dollar Pier.

Lost and Found

LOST—Badges Nos. 4252, 5215, 5549 and 8517. Return to Registration Booth.

Bean and Phelps Improving

W. L. BEAN, mechanical manager of the New Haven, his mother, Mrs. S. L. Bean, and B. P. Phelps, engineer of shop extension of the Santa Fe, who were seriously injured in the automobile accident late on Saturday afternoon and who are now in the hospital at Atlantic City, are reported to be resting easily. The nature of their injuries is such, however, that it will be some time before they will be able to leave the hospital.

Entertainment Yesterday

THE informal dance on the Million Dollar Pier last evening proved to be a most delightful occasion and was remarkably well attended. The special features were the Famous Wroes Buds Revue and Minuet and the Reading Company's Seashore Band. Howard J. Melaney, the singing fireman from the Yellowstone division of the Northern Pacific, sang most acceptably.

The committee in charge of the dance was under the chairmanship of L. B. Rhodes. The other members were I. H. Jones, vice-chairman, R. R. Paradies, H. E. Passmore, L. P. Pratt, L. R. Pyle, W. S. Rose, J. L. Rowe, K. F. Sheeran, E. A. Thornwell, R. P. Townsend and R. R. Root.

Registration Figures

AT 3.30 yesterday afternoon (Monday) the total registration figures had almost caught up with those of 1926. A distinct increase in shown in the attendance of railroad men and railroad ladies, but this does not as yet quite offset the heavy falling off in the attendance of supply men.

REGISTRATION FIGURES

	1920	1922	1924	1926	1928
Mechanical, Division V	805	950	1143	1340	1389
Purchases and Stores, Division VI	406	333	365	486	491
Motor Transport, Division VIII					56
Railroad guests					588
Railroad ladies	746	924	1075	1140	1236
Supply men	2465	2285	2613	3084	2605
Supply ladies	660	569	673	700	731
Special guests	687	800	809	738	32
Complimentary					299
TOTAL	5769	5861	6678	7482	7427

Convention Pays Tribute to C. F. Giles

DURING the session of the Mechanical Division on Monday, the convention authorized the secretary to send the following telegram to C. F. Giles, former superintendent of machinery of the Louisville & Nashville and, until this year, a member of the General Committee of the Mechanical Division since its organization. Mr. Giles, because of ill health, is unable to attend the convention this year:

"The Mechanical Division of the American Railway Association, in convention asembled, recalling your long and active membership and especially your faithful and regular atendance at the annual meetings, sends you cordial greeting, with all good wishes for the return of your health and for the happiness which you so richly deserve."

A. R. E. A. Committees Meeting Here

A large number of leading officials in the engineering and maintenance of way departments of the railways are here for the purpose of attending the meeting of the committee on standards of the American Railway Engineering Association which is to be held today. This committee is composed of the chairman of all standing committees and E. B. Cushing, of the Pennsylvania, is chairman of it.

Another meeting will be that of the chairmen of all standing committees with the committee on the personnel of committees, which will outline the work of all committees for the next year.

There will also be a meeting of the board of direction of the American Railway Engineering Association. The decision to have the meetings of these various committees of the A. R. E. A. in Atlantic City at this time was due to a growing realization of the need for better co-operation between the Mechanical and other divisions of the American Railway Association that have been holding their conventions here, and the Engineering Division of the A. R. A. One of the results will be that the exhibit will be seen by more of the engineering officers of the railways than probably was ever the case before.

The various committee meetings mentioned will be held at the Strand Hotel.

Registration, American Railway Association

Division V—Mechanical

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Barr, L. S., Mech. Supt., Live Poul. Tran., Shelburne
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Kleine, H. J., Asst. M. M., Penna., Dennis
Knapp, Arthur, Insp. Eng., N. Y. C., Dennis
Knorr, R., Shop Supt., Erie, Princess
Knowlton, C. H., Asst. Eng., N. Y. C.
Koch, G. B., Gen. For., Penna., Chalfonte
Kraft, E. A., Supt. Tank Car Maint., Pure Oil, Brighton
Kurfess, L. S., Asst. Supt. Car Dept., Erie, Ritz
Laizure, L. R., M. M., Erie R. R., Strand
Landig, J. J., Chem. & Eng. Tests, D. L. & W., Haddon Hall
Lang, W. C., M. C. B., P. & L. E., Jefferson
Lawhon, A. M., G. M., Sou., Shelburne
Leonard, W. W., Elec. Car Lgt. Supt., B. & O., Princess
Lloyd, S. P., Asst. For., P. R. R., Penn Alto
Lofgren, John F., Test Dept. Insp., Penna., York Hotel
Lohfink, William, Pie. Wk. Insp., C. of N. J.
Love, H. G., Shop Supt., G. T. W., Maison
Lowe, T. W., Gen. For., Penna., Traymore
Lower, Martin, Asst. Gen. Mgr., Owasco River, Traymore
Luddy, W. E., E. H. F., Penna.
Ludwig, Daniel, Asst. For., Reading
McCue, Thos. B., For., Reading, Stanley
McDonnell, Dr. M. E., Ch. Chemist, P. R. R., Haddon Hall
McGill, A. M., Asst. S. M. P., L. V.
McKee, R. G., M. M., C. & O., Ritz
McMillan, A. E., Dist. M. M., B. & O., Haddon Hall
McMullen, John, Supt. Car Dept., Erie, Ritz
McNichall, Chas., Supt., McKeKesport Conn., Colton Manor
McVicker, Wm., Asst. Gen. For., Penna.
Markland, A. R., Mot. Pow. Insp., Penna.
Marr, Frank, Gen. Supv. of Piece Wk., N. Y. C., Chelsea
Marshall, Harry F., Asst. Eng. Val. Dept., Reading, Lexington
Martin, J., Gen. For., C. C. C. & St. L., Colton Manor
Martin, L., Ch. M. C. B., B. & O., Pennhurst
Matthes, John, Jr., Gen. Car Insp., Wab., Pennhurst
Mauger, John T., Gen. For., Reading, Elks
Mayer, A. W., Gen. For., N. Y. C., Traymore
Mears, R. J., Ch. Draft., N. Y. C.
Meister, C. L., Mech. Eng., A. C. L., Llewellyn
Melaney, H. A., Spec. Traf. Rep., No. Pac., Ritz
Mendler, C. H., Car For., N. Y. C., Strand
Merrick, G. A., Asst. to Mech. Eng., N. Y. N. H. & H., Stevenson
Messimer, W. N., Gen. Car Insp., N. Y. C., Traymore
Middaugh, W. H., Div. Car For., Erie, Pennhurst
Miers, A. M., Insp., N. Y. C.
Miller, A. T., Asst. to S. M. P., A. & W. P., Ritz-Carlton
Mills, M. J., M C B, P. M., Ritz-Carlton
Moncure, A H., Gen. For. Car Dept., R. F. & P., Dennis
Moore, S. J., Supt. Trans. H. & S., Ritz-Carlton
Moran, J. J., For., N. Y. C.
Morris, J. M., V. P., L. Term., Colton Manor
Murray, E. A., Shop Supt., C. & O., Ambassador
Murphy, John L., Asst. Gen. For., B. & A., Ritz-Carlton
Nance, O. H., Pres. & G. M., M. & P., Traymore
Naylor, H. R., Asst. Works Mgr., C. P. R., Chalfonte
Neesley, F. P., Asst. S. M. P., Mich. Cent., St. Charles
Nelson, F. W., M. M., N. Y. N. H. & H., Traymore
Nevins, B. E., M. M., Vir., Traymore
Newman, W. A., Mech. Eng., C. P. R., Haddon Hall
Nickol, W. A., Asst. Supv. Mot. Pow., Penna.
O'Donnell, B., Shop Supt., N. Y. C. & St. L., Breakers
O'Donnell, F. J., Ch. Interchange Insp., Niagara Frontier Car Insp. Assn., Pennhurst
O'Neal, James, Gen. Car For., G. M. & N., Haddon Hall
Orr, B. F., Supt. Car Shops, C. C. C. & St. L., Colton Manor
Ortner, Jos., Ch. Shop Insp., Erie, Knickerbocker
Ott, W. B., M. M., Penna.
Pancake, A. L., Reading, Beachside
Paradis, E. M., Ch. Chem., N. Y. C., Ambassador
Perry, M. R., Ch. Trav. Car Rep., B. & O., Lexington
Peters, J. C., Supt., Reading
Phillips, O. W., Gen. Car For., S. & A., Knickerbocker
Phipps, J. W., A. R. A. Insp., B. & O., Kenderton
Porter, Geo. H., For. Elec. Mot. Pow., Reading, Knickerbocker
Querry, M. F., Gen. Car For., N. Y. C. St. L., Ritz
Quinlan, F. T., Eng. of Tests, N. Y. N. H. & H., St. Claire
Quinn, J. H., Gen. For., Penna.
Rabbitt, T. G., Mech. Div., Sun Oil Tank, Brighton
Raether, R. C., Asst. C. E., M. C., Dennis
Raltz, S. J., Asst. Mech. Eng., B. & M., Traymore
Reed, James, Dis. M. C. B., N. Y. C., Traymore
Reid, J. C., Shop Supt., N. Y. N. H. & H., Penn Alto
Reid, R. A., M. M., P. M.
Rhodes, C., Div. Car For., Erie, Traymore
Rice, R. M., Mot. Pow. Insp., Reading, Colton Manor
Richards, E. C., Asst. S. R. S., Mich. Cent., Traymore
Rickley, Fred, Elec. For., Reading, Knickerbocker
Ritter, Otto H., M. M., N. Y. N. H. & H., Traymore
Roach, J. E., Gen. Car For., N. Y. C., Strand
Robinson, W. R., A. R. A., N. Y. C. & St. L., Colton Manor
Romig, John S., Asst. M. M., P. R. R., Dennis
Root, Jos., Jr., Asst. V. P., U. T. Car Co., Traymore
Rousch, C. S., Asst. M. M., Penna., Dennis
Runkle, David F., For. Car Shop, Reading, Somerset
Russell, Frank E., Mech. Eng., So. Pac., Marlborough
Russell, Walter L., Rhse. For., Reading, Stevenson House
Ryan, Edward J., Gen. Car For., B. & O., Brighton
Ryan, J. M., Gen. Insp. C. D., C. St. P. & M. & O., Chalfonte
Sandhas, H. L., Genl. Insp., C. R. R. of N. J., Lexington
Saum, Geo. U., M. C. R., C. & W. I., Colton Manor
Saunders, T. A., M. C. B., T. C., Kentucky
Scheffer, C. A., For., Penna., Penn. Atlo.
Schmehl, Geo. J., For., Reading, Norway
Schmidt, Anthony, Car For., C. of N. J.
Schmidt, V. P., Shop Insp., Penna., Traymore
Schuyler, A. J., Gen. Car Insp., Vir., Ritz
Scott, J. B., G. M., Armour Car Lines, Ritz-Carlton
Scott, W. W., M. M. P. E. C., Ambassador
Seiders, Irwin A., S. M. P. & R. Equip., Reading, Dennis
Seifert, S. P., Supt. Car Dept., N. & W., Ritz
Selloy, S. H., For. C. D., B. & O., Pennhurst
Semple, J. S., Asst. R. F. F., B. & O.
Senger, J. W., Supt. R. S., N. Y. C., Traymore
Shea, W. B., Shop Supt. Mo. Pac., Strand
Sherwood, Fred, Equip. Insp., N. Y. C.
Shull, F. E., Marlborough
Shults, L. W., M. M., Sou., Rittenhouse
Sigwairt, H. A., Supv. Car Bills, Mo. Pac., Ritz
Silverman, Mortimer, Asst. to Pres., B. & M., Marlborough
Simpson, F. C., M. M., Sou., Rittenhouse
Sitterly, W. H., Gen. C. Insp., P. R. R., Craig Hall
Sloan, J. R., Ch. Elec., Penna.
Smallwood, C. H., Gen. Car Insp., I. C., Strand
Smith, Abram E., V. P., C. U. T. C., Traymore
Smith, J. H., Ch. Draft., C. of N. J., Osborne
Smith, J. J., Spec. Engr., P. R. R., Haddon Hall
Smith, P. G., Asst. to S. M. P., Mo. Cent., Ambassador
Smith, W. F., Loco. Draft., So. Pac., Traymore
Smith, Wm. C., Supt. Pit Insp., N. Y. N. H. & H., Richmond
Snell, Wm., Dist. M. C. B., C. M. S. P. & P., Strand
Snyder, D. F., For., C. R. R. of N. J.
Snyder, J. G. For., P. R. R., Strand
Spangler, C. L., Asst. M. M., Reading, Colonial
Speck, H. J., Gen. Foreman, D. W. P., Elberon
Stair, Jacob, Jr., Ch. Elec., Penna.
Starr, F. A., Supt. Recl., C. & O., Princess
Stebler, W. J., G. M., Conley Tank Car, Marlborough
Steelwagon, W. B., Asst. F. R. M. P. & R. E., Reading, Somerset
Steinberger, F. W., For., Reading
Stevenson, F. M., Mech. Eng., Penn. Tank Line, Traymore
Stewart, M. D., S. M. P., Sou., Chelsea
Stogren, H. A., Asst. Mech. Eng., C. M. St. P. & P., Breakers
Strain, C. E., Gen. For., H. V., Ambassador

Strattan, G. E., Insp., Penna., Penn-Atlantic
Strill, T. V., For., Reading
Sweeley, E. A., Mech. Supt., Frt. Grow. Exp., Shelburne
Sweeney, V. L., Sr., Asst. C. C. to S. M. P., R. F. & P., Knickerbocker
Sweetman, E. M., S. M. P., Sou., Traymore
Tait, Edwin E., Pres. P. & S., Marlborough
Tangye, W. A., A. B. For., B. & O.
Tayler, C. S., Shop Supt., A. C. L., Llewellyn
Taylor, S. O., M. C. B., Mo. Pac., Ritz
Teed, F. A., Gen. Car For., B. & O., Ambassador
Teufel, W. O., Asst. M. M., Penna.
Thomas, C. H., Matl., Insp., C. & N. W., Traymore
Thompson, D. B., Mech. Eng., N. Y. C., Glaslyn Chatham
Thompson, Geo E., Dist. M. C. B., N. Y. C., Ritz
Thompson, John S., Asst. For., Reading
Thompson, W. O., Equipt. Asst., N. Y. C., Traymore
Thorn, W. H., M. C. B., C. S. & P. M. & O., Marlborough
Tiley, Geo. E., Supv. Tank Car Equip., Gen. Chem., Brighton
Tinder, F. S., Shop Supt., Virginian, Strand
Trumbo, P. R., Mat. Insp., C. & O., Traymore
Turner, J. S., Pressed Steel Car, Shelburne
Van Der Bogart, J., Gen. For., N. Y. C., Traymore
Van Valin, H. D., Sales Div., Std. Oil Co., La Fayette
Vick, R. E., Trav. Car Insp., M. & O., Knickerbocker
Wallace, O. A., Supv. Car. Rep., A. C. L., Chalfonte
Walter, P. S., Asst. Ch. Car Insp., P. R. R., Elberon
Waring, F. M., Engr. Tests, P. R. R.
Warner, Wm. T., Asst. Supt., Reading, Jefferson
Warren, A. E., Gen. Mgr., Can. Nat., Ambassador
Warren, H. M., E. E., D. L. & W., Colton Manor
Watson, B. B., Insp., P. R. R., Dennis
Weaver, C. F., Supt. Car Shops, Can. Nat., Haddon Hall
Weber, L., For., C. of N. J., Craig Hall
Weight, C. C., Gen. Car Insp., Penna., Sterling
Weightman, J. J., Ch. Cl., Reading
Weiler, G. S., Gen. Car For., G. C. & S. F., Osbourne
Wendelken, F., Capt. Marine Dept., Erie
Werts, James R. For., Reading, Elberon
Werts, James, Sr., Asst. For., Reading, Elberon
West, G. S., M. M., P. R. R., Chalfonte
Westall, W. T., Asst. M. C. B., N. Y. C., Ambassador
Westbrook, M. H., Shop Supt., Can. Nat.
Wetzel, N. F., Plant Eng., C. C. C. of St. L., Colton Manor
Weyman, E. H., M. C. B., K. C. S., Ambassador
White, Lowell, Gen Supt., A. C. L., Marlborough
White, C. A., Shop Supt., A. C. L., Kentucky
Whitfield, Ernest O., Asst. Engr., N. Y. N. H. & H., Shelburne
Wilbur, Rollin H., V. P. & G. M., L. & N. E.
Wilcox, E. M., M. C. B., Ritz
Wilcox, M. E., Asst. Supt. Car Main., B. & M., Ritz
Wiles, G. F., Dist. Mot. Pow. Insp., B. & O., Princess
Wilkinson, B. L. Draftsman, N. Y. C., Morton
Williams, J. S. M. M., C. & O., Ritz
Williamson, G. B., Trav. Car Rep. Acct., B. & O., Pennhurst
Wilson, D. H., Supt of Shops, F. E. C., Sterling
Wilson, G. T., Gen. Equip. Insp., N. Y. C.
Wink, L. R., Asst. Supt. Car Dept., C. & N. W., Marlborough
Winship, R. B., Asst. M. E., C. P. R., Haddon Hall
Winterrowd, W. H., V. P., Lima Loco. Wks., Marlborough
Womble, J. W., Mech Supt., M. V., Breakers
Wood, G. N., Supv. A. B., A. T. & S. F.
Woodrow, H. H., Supt. R. S. & E., B. R. T., Castro
Woodward, F. S., Asst. Engr., N. Y. C., Ambassador
Wright, Ashley L., For. B. & A., Jefferson
Yeager, Geo. F., Insp. Test Dept., Penna., Brighton
Yergy, H. J., Ch. Car Insp., Penna., Penn Alto
Yohn, A. M., Gen. Man., H. R. T. R., Lovain
Young, C. O., Gen. Mech. Insp., I. C., Ritz-Carlton
Young, J. B., Eng. of Tests, Reading, Chalfonte
Ziebold, A., Mech. Insp., H. V., Ambassador

Division VI—Purchases and Stores

Buckland, Chas. C., Asst. G. S., N. Y. N. H. & H.
Cooper, D. E., Supt. of Stores, B. & O., Shelburne
Hosfeld, C. A., Sec. to P. A., B. & O., Monticello
Keyes, R. W., Ch. Matl. Insp., N. Y. N. H. & H., Marlborough
McWhite, G. E., Asst. P. A., A. B. & C., Craig Hall
Skilling, J. K., Spec. Agt., B. & O.
White, G. D., Stk., N. Y. C.

Special Guests

Sylvester B. P. Adams, Y. M., A. C., Atlantic City
Wm. Austin, Of. Eng. Val. Dept., Reading
J. H. Bachman, Air Brake Insp., Penna., Haddon Hall
Ephriam Bakley, Eng., Reading
Theo. Baldo, For., P. R. T., Dennis
C. W. Baldridge, Asst. Eng., A. T. & S. F., Strand
Frank L. Barker, Cl., C. R. R. of N. J., Robert
H. W. Barney, Draft., Reading, Tabor Inn
Wm. M. Barr, Cons. Chemist, U. P., Ambassador
H. N. Bast, For., B. & O., Craig Hall
C. L. Baughman, Asst. Pass. M., Penna.
Fred W. Bender, Sig. Engr., C. R. R. of N. J., Strand
W. J. Bohmer, Draftsman, B. & O., Kentucky
B. D. Branch, G. P. A., C. R. R. of N. J.
H. F. Brendel, For. Car. Insp., C. of N. J., Penn
Otto Brendel, Car For., C. of N. J., Penn
S. S. Brooks, Supt., Sou., Traymore
H. F. Brown, Asst. Elec. Eng., N. Y. N. H. & H.
Wm. Brown, S. & F. Agt, Reading, Strand
R. L. Brown, A. R. A. Cl., A. C. L., Raleigh
Chas. H. Browne, For., Reading
J. A. Bucy, Elec. For., B. & O., Fredonia
G. H. Buttron, N. Y. C.
N. A. Camera, Supv. of Tracks, Wash. Term. Co., Ambassador
Frank A. Cardiegna, Draftsman, B. & O., Kentucky
P. C. Cassidy, Asst. R. F. E., Reading, Osborne
Robt. De Cesare, Ch. Cl. to Shop Supt., N. Y. N. H. & H., Marlborough
W. S. Chamberlain, Marlborough
Gordon Chambers, Real Estate Agt., Reading
U. V. Clark, Ch. Cl., B. R. & P., Marlborough
Wm. A. Clark, Supvr., Reading, Ambassador
Albert Clarkson, Jr., Gen. Insp., N. Y. C. R. R., Chalfonte
P. Clement, Car For., C. of N. J., Penn
L. C. Clemson, P. R. R., Strand
W. T. Clishian, Draft., B. & O.
J. T. Colbert, Gen. Supt., P. & S., Marlborough
H. G. Connor, Shop Clk., B. & O.
J. Connor, Secy. to G. M., Can. Nat., Ambassador
J. W. Conroy, C. R. I. & R., Arlington
M H. Coulston, Gen. Counsel, P. R. R.
T. Cross, For., C. R. R. of N. J., Sterling
W. F. Cummings, Asst. Secy., S. A. L.
Jacob H. Deaven, For., Reading
Clark D. Dillenbeck, Ch. Eng., Reading
B. W. Ditmore, Marlborough
M. J. Donovan, For. Mech. Dept., P. R. R., Plaza
J. A. Dougherty, Frt. Agt., G. T. C. N.
A. F. Duffy, I. C. C. Insp., Bureau of Safety, Princess
F. E. Edwards, For., N. Y. C. R. R., Chalfonte
A. W. Epright, Supvr. Scales & Weighing, P. R. R. Craig Hall
W. Ernst, Genl. Equip. Insp., N. Y. C., Jefferson
E. E. Everett, Che. Clk., N. Y. C., Marlborough
Geo. N. Ewing, Asst. T. M., Reading
Frank Fahlan, N. & W., Craig Hall
C. H. Faris, N. & W., Craig Hall
R. H. Ford, Asst. Ch. Eng., C. R. I. & P., Strand
James V. Galvin, Gen. Yd. Mtr., Reading, Wellsboro
W. W. Gardner, W. J. & S.
Paul W. Gehris, Draftsman, Reading
F. R. Geiselman, B. & O., Kentucky
H. J. German, Pres., Montour
Geo. Graeff, Asst. For., Reading, Elberon
W. F. Gray, Prof. Purdue Un., Strand
K. S. Gregg, Draft. Eng. Dept., Reading, Tabor Inn
W. Grimminger, For., P. R. R., Penn Atlantic
W. A. Grove, Com'l Agt., L. V.
A. C. Hacker, Car Dept. A. R. A., N. Y. C.
H. L. Hamilton, Asst. Eng. Matl. Insp., N. Y. C.
Allen M. Hawman, Asst. Ch. Cl., Penna., Montcella
T. C. Hays, I. C. C., Shelburne
F. N. Heilig, Asst. For., Reading, Elberon
Norman E. Heiser, Reading, Lloyd
Geo. B. Hershey, M. D., Surgeon, Penna., Nexler
Geo. R. Hildabrant, Cl. Acct. Dept., A. C., Christiana
F. A. Hildebrand, For., N. J. & S.
G C. Hinkel, Draftsman, B. & O., Kentucky
Howard G. Hoke, Penna., Chalfonte
I. H. Hopkins, Traymore
P. Hummel, Train Master, Reading
Geo. Hunt, Agt., Reading, Jefferson
W. Hunter McDowell, Cost Eng. Val. Eng., Reading
J. G. Jeffreys, For., Sou., Haddon Hall
T. H. Jones, For. Eng., Lackawanna, Neptune
Chauncey R. Kay, Draftsman, Reading
Ralph B. Kehler, For., Reading, Blackstone
W. Keim, For. Car Dept., N. Y. C., Pennhurst
E. J. Kelley, Ch. Elec. Insp., N. Y. N. H. & H., Glaslyn Chatham
C. V. Kilmer, Trav. Car Rep. Acct., B. & O., Lexington
J. W. King, Reading, Strand
C. W. Klinedinst, Agt., P. R. R., De Ville
F. Krafft, For., C. R. R. of N. J.
A. Kubli, Dist. Pur. Agt., C. R. R. of N. J., Jefferson
Harry Lacerda, Supvr., D. & H.
Carl H. Learsch, Clk., C. R. R. of N. J., Robert
F. H. Lee, Jr., Raleigh
John Leppington, For., C. R. R. of N. J., New Brady House
T. E. Lewis, Supt. Car Dept., N. & W., Runnymede
R. W. Lieblong, Elec Insp., N. Y. C.
Walter Lloyd, Penn Alto
F. L. Loughlin, Erie, Jefferson
J. H. McClintock, T. M., Penna., Thompson
R. M. McCurdy, P. R. R.
J. McGarrity, Ritz
M. F. McCauley, Y. M., Reading
G. E. McWhite, Jr., Craig Hall
J. E. Mahatcek, Draftsman, N. Y. C., Traymore
Daniel C. Malone, A. B. For., Mer. Disp., K. of C.
Capt. J. W. Marsh, Ry. Equip. Eng., U. S. Army
Raymond Mattern, Asst. For., Reading, Lexington
F. A. Merrill, Trav. Car Rep. Acct., B. & O., Lexington
W. D. Messimer, Traymore
C. G. Meyer, Ch. Clk. to S. M. P., N. Y. C. & St. L., Shelburne
W. L. Miller, Asst. For. Car Dept., N. Y. C., Pennhurst
W. H. Montgomery, Penna.
Edw. E. Morningstar, Draft., B. & O., Louvain
W. W. Morrison, Ch. Engr. P. & S., Marlborough
J. J. Moynihan, Supt. of Trans., Erie, Lafayette
Wm. E. Mumford, Baggage Agt., Reading
T. E. Newell, R. E. Dept., 9 Bartram Place
Wm. F. O'Donnell, Pennhurst
Frank Ott, Ch. Inter. Insp., Keystone
John L. Parker, Mo. P. Insp., Penna.
D. J. Paskey, For., C. R. R. of N. J.
H. Pattison, Engr. Elec. Trac., Virginian
W. Paulsen, Tram. Engr. Dept., B. & O.
Geo. W. Perry, Jr., For. Car Insp., Reading
I A. Petersen, Haddon Hall
Earl W. Peterson, Asst. Eng., B. & M.
H. H. Peterson, Toolmaker, Reading, Somerset
Kunibert Picker, Jr., Draftsman, B. & O., Kentucky
H. J. Pollock, Draftsman, B. & O.
T. S. Porcher
J. J. Prendergast, Rd. Hse. For., T. & P., Ritz-Carlton
C. W. Rapine, Mach., Reading, Princess
Ratchiff, T. R., Engr. M. of W., Ind. Un.
Geo. W. Reeves, Asst. T. M., Reading
J. H. Remick, Ch. Cl. to M. C. B., N. P., Ritz-Carlton
J. J. Ross
J. T. Ridgely, Eng. Maint. Way, L. I., Shelburne
John F. Rodgers, Asst. to V. P., Phila. Rapid Trans., Dennis
W. C. Royer, Chalfonte
C. H. Runkle, Reading

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Conventionalities

Harry W. Johnson, of the M. & St. L., upon hearing a remark that the days were getting longer, said he did not object to that but was troubled by the short nights.

George B. Finch, sales manager of the Belden Manufacturing Company, is out for honors as the tallest man at the convention. He reports his height as five feet eighteen.

Douglas Wilson, son of Lyn. Wilson, of the Bird-Archer Company, has gone direct from Illinois University to a position (job) at Tacoma, Wash., on the C. M. St. P. & P.

According to reports received yesterday, Paul Weiler, of the Franklin Railway Supply Company, who is confined by critical illness in the Brooks Memorial Hospital at Dunkirk, N. Y., is much improved.

One of the largest family parties at the convention this year is that of A. L. Whipple, of the Standard Stoker Company. Mr. and Mrs. Whipple are accompanied by Miss Dorothea and their two sons, Richard and Ward.

Charles W. Bell, who has attended previous conventions as a representative of the Electric Storage Battery Company, is in attendance this year in the capacity of general sales manager of the Gould Storage Battery Company.

S. P. Seifert, superintendent car department of the Norfolk & Western, has been with that railroad for 38 consecutive years, never having been off the pay-roll—a fine record for continuous work. This is about his twenty-fifth convention.

George L. Bourne, president of The Superheater Company, arrived at the convention Monday morning with his son Billy, who is 16 years old. Billy, who attends the Choate school at Wallingford, Conn., has grown rapidly since his last convention and is now bigger than his dad.

Mrs. Harold B. Gardner, formerly "Bobby" Besler, whose husband is with the Westinghouse Air Brake Co., New York, dropped in for a little visit to the conventions and is stopping with Harold, Jr., and her mother, Mrs. William G. Besler, at the Ambassador.

The seventeenth hole of the Seaview Golf Course, which is only 110 yards long, has wrecked many prospects of good scores, but Dave Pye says that George Rink should have the prize for playing this hole wrong, because he drove the green all right and then took four putts.

Dave Redding, formerly superintendent of motive power of the Pittsburgh & Lake Erie, is missed at the conventions this year. He passed away the early part of last December. Mrs. Redding has been ill for several months and is convalescing in a hospital in Pittsburgh.

Victor W. Ellet, the new vice-president, and E. J. Fuller, the new sales manager of the Hunt-Spiller Manufacturing Corporation, are attending the conventions this year for the first time under these titles. Both Mr. Ellet and Mr. Fuller have been in the Hunt-Spiller organization for many years.

C. H. McConnell, mechanical engineer, Pittsburgh & Lake Erie, is accompanied this year by Mrs. McConnell and their two sons. The older son, Charles, is in his third year at Washington and Jefferson, and the younger son, who attended the convention for a few days two years, will enter that college this fall.

Warren C. Hamm, mechanical engineer of the Central Vermont, is the proud possessor of a five-weeks old son. This is Warren's first child; while he was unable to attend the annual meeting of the New England Railroad Club because of the event, his friends are glad to have an opportunity to congratulate him at Atlantic City.

Earl M. Harshbarger, formerly New York district manager for S. F. Bowser & Co., is attending the convention this year in his new capacity as eastern railway sales representative for SKF Industries, Inc. Mrs. Harshbarger is here again, and they both say, "It won't be long now until the world will be riding on roller bearings."

Frank Barbey, of Boston, had quite a shock when he finally found himself in the photograph of the 27th convention of the Master Mechanics' Association which was published in Monday morning's Daily. He seemed to be very much at home, for as usual, he was grouped with the only two ladies in the picture; he will be found in the upper left corner.

Frank Snyder and Guy M. Gray, vice-president and general manager, and superintendent of motive power, respectively of the Bessemer & Lake Erie, have found the convention and exhibit so attractive that they have decided to stay until the finish. Mr. Gray has recovered from his serious illness of last winter which required him to go to warmer climates for several months.

R. A. ("Bob") Dennis, of the Remington-Rand Business Service, who had 25 years experience in railroad service, says that during the next two years he is going to devote his time to inventing a "booster" comparable to the locomotive booster, which can be applied to convention visitors after about the third day, as after that time it is quite difficult to make some of the hills.

L. C. Hensel, formerly associated with the Edison Storage Battery Company, is attending the conventions this year as manager of railway sales for the Gould Storage Battery Company, Inc. For 21 years Mr. Hensel was electrical engineer for the Frisco Lines. He has the distinction of supervising the construction during the World War of the largest storage battery ever built for submarine service.

Fred A. Schaff, vice-president of The Superheater Company, who has just returned from Europe with Mr. Bourne, president of the company, reports that the prog-

ress in the use of high-pressure steam locomotives in Germany is developing rapidly. Both he and Mr. Bourne returned in time to attend the annual outing of The Superheater Company at Forest View Landing on the Hudson, at which there were in attendance some 300 or 400 people.

W. L. Conwell, president, and J. H. Rodger, vice-president of the Safety Car Heating & Lighting Company, are here this year with their new pet in the silica-gel iceless refrigerator car. This new type of refrigeration for transit purposes has attracted considerable attention at the track exhibit. So far there have been 31 of these cars built and they have shown very satisfactory results in the shipment of fish from the northeast coast into the hot sections of the southwest.

R. H. Ford, assistant chief engineer of the Rock Island, who was looking over the exhibit yesterday, is chairman of the committee of the American Railway Engineering Association on co-operation of the universities with the transportation interests, and is very much interested in the problem of having practical and helpful courses in transportation given in the universities, and also in having college educated men given broader opportunities in railway service.

A. McGary, chief electrician of the car department for the New York Central, is proud of his daughter, Ethel, who is a swimmer of national reputation. As a member of the Women's Swimming Association, Miss McGary last week, at Briar Cliff, became the national woman's champion in the 400-meter, 500-yard and 1,500-meter dashes. She also holds the record as the woman's national long distance swimmer. Miss McGary graduated this spring from New York University.

Among the prominent street railway men who visited the exhibit over the week-end were Frank H. Hedley, president of the Interboro Rapid Transit Company, and W. G. Gove, superintendent of equipment of the Brooklyn-Manhattan Transit Company. Mr. Gove will, next November, complete a most successful term as president of the New York Railroad Club. A number of distinctive improvements have been made in the club procedure and programs during his administration.

W. L. Garrison, assistant manager of the locomotive department, Ingersoll-Rand Company, is to be seen sporting a new hat, which we understand was annexed on one of his recent southern trips to either further the sale of the oil-electric locomotive, or to address a gathering of railroad men which he has been doing quite often recently. The hat only needs the addition of a feather and a flashy band to make it look like the style of headgear worn by Alpine mountain climbers.

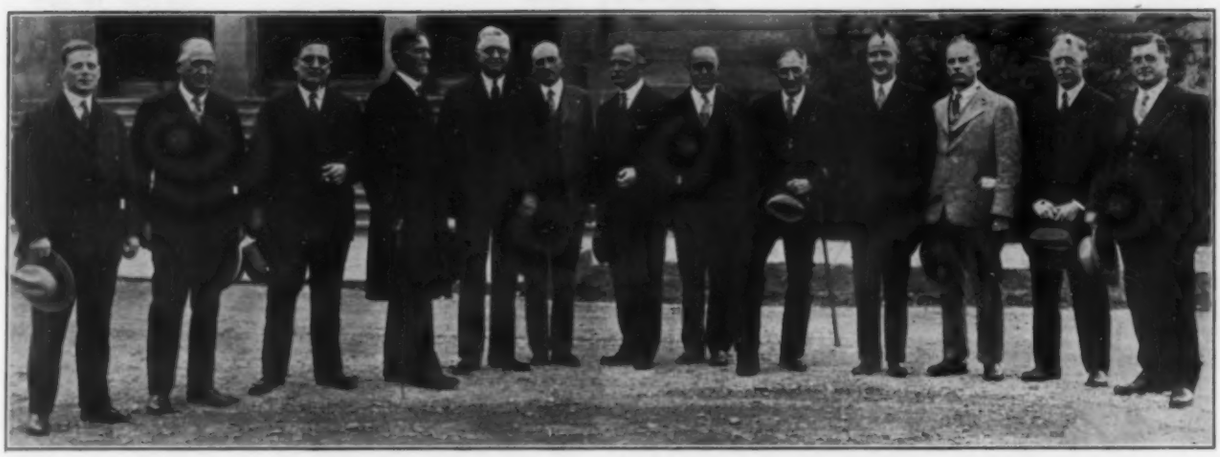
In addition to Commissioner McManamy, a number of men connected with the Interstate Commerce Commission in important capacities are attending the conventions and studying the exhibits. These include Harvey Boltwood, assistant director of service; W. J. Patterson, assistant director of the Bureau of Safety; Oscar Cash, chief inspector of safety appliances; A. G. Pack, chief inspector of locomotives; John A. Shirley, assistant chief inspector of locomotives; John Hall, assistant chief inspector of locomotives, and John Adair, mechanical engineer of the Locomotive Inspection Department.

We have heard of many quaint and odd hobbies of railway and supply men, but we think the prize goes to Charles P. Ressler, research engineer of the Reading Iron Company. Donald Charlton, of that company, is authority for the statement that Mr. Ressler has recently planted 13,000 trees on his country place five miles outside the city of Reading, Pa. This young forest consists not of 13,001 or 12,999, but exactly 13,000 trees. Anyone doubting this statement is invited by Mr. Ressler to visit his summer home and count the trees for himself.

Lawrence Richardson, mechanical superintendent of the Boston & Maine, on his arrival at the convention announced a new form of live stock transportation, which, so far as is known, has never been tried on any other railroad. On the arrival of an eastbound freight train at the Deerfield, Mass., terminal, recently, a monkey, very much excited and apparently not entirely pleased with his ride, unloaded himself from the top of the tender brake cylinder. Investigation disclosed that he had made the entire trip from Mechanicsville, N. Y., as he was later identified as belonging to a circus, which was at that time playing in the vicinity of the Mechanicsville terminal.

M. H. Westbrook, shop superintendent of the Grand Trunk at Battle Creek, Mich., week before last attended the first younger railroad men's conference in Canada. The Canadian Pacific and the Canadian National were jointly interested in the event, about 180 young men under the age of 21 attending the meeting. The young men were greatly stimulated and helped in their efforts to find themselves and better prepare themselves for their life work. Incidentally, if we may judge from Mr. Westbrook's attitude, the railroad officers who conducted the vocational counseling groups were also inspired to take a deeper interest in the welfare of the young men under their charge.

Two Presidents—President Aishton of the American Railway Association on the Right, and President W. H. S. Bateman of the R. S. M. A.



Group of Railway Officers, Members of the Purdue Faculty, and Officers of the Bureau of Safety, at Purdue University to Inspect the Air Brake and Draft Gear Tests

Div. V Discusses Car Equipment

Reports on Safety Appliances, Locomotive and Car Lighting, Brakes and Brake Equipment, and Couplers and Draft Gears

The first of the final three days' sessions of the Mechanical Division convention was opened by Chairman Smart at 9.30 A. M., yesterday morning. The report on Locomotive and Car Lighting, which had been held over from Friday morning's session, was presented by A. E. Voight, in the absence of committee chairman, W. E. Dunham, (C. & N. W.). This report was followed by an address on Aviation by Major Clarence Young, director of aeronautics, Department of Commerce.

Report of Committee on Locomotive and Car Lighting

A general revision of specification for axle generator equipment has been completed

W. E. Dunham
Chairman

During the past year, the committee has given attention to the subject of axle belt drive, photometry of headlights, specifications for axle generator equipment, motor coach and street railway lighting and switch engine headlights. A complete copy of the report, with the exception of illustrations and parts VII and VIII of the appendix concerning lamp regulators, follows:*

Axle Belt Drive

There have been no new developments, except that the manufacturers are now in a position to furnish pulleys up to 20-in. width face with single hub mounting to those desiring same.

Photometry of Headlights

As a continuation of the work of previous years, progress has been made to the extent that several proposed methods of measurement have been tried and found to be barren of useful results. At this time, there are no additional proposed methods before the committee for consideration.

Specifications for Axle Generator Equipment

The general revision of these specifications undertaken last year has been carried out jointly with the Car Lighting Committee of the Association of Railway Electrical Engineers. This specification is presented herewith with the recommendation that it be adopted as Appendix D of Section H of the Manual.

The effort has been to retain all the fundamental requirements of the old specification with such changes as are necessary to keep abreast of progress in practice and development.

With a view to simplification, some detail matter which may more properly be left to the discretion of the manufacturer or individual road has been omitted.

Revision of Section H of the Manual

The subjects remaining to complete this, after addition of the revised specification for axle generator equipment, if adopted, are motor coach and street railway lighting.

Switch Engine Headlights

The desirability of reducing glare as far as practicable is recognized, but the use of inside frosted 100-watt lamp, covered by footnote under table of lamps for locomotive lighting service, in Appendix C of Section H of the Manual, cannot be recommended until it is conclusively established that this type of lamp will provide the required pick-up distance throughout its life.

Appendix D—Specifications for Axle Generator Equipment

I. General

1. (a) These specifications cover axle generator equipment for the . . . . . Railroad, delivery to be made f. o. b. manufacturers' works.

(b) Submission of bid will be understood to imply that manufacturer fully understands and accepts the requirements imposed by, and will furnish apparatus which will comply with these specifications.

(c) Material and workmanhsip shall be the best of their respective kinds.

(d) The accredited representative of the Railroad shall be the sole judge, on all questions that are not capable of measurement and record, as to whether or not the apparatus complies with the specification.

2. The apparatus to be furnished shall consist of:

(a) Axle generator.

*Three illustrations, covering four figure numbers, accompany the report. They duplicate illustrations published in previous reports and are not included in this abstract. Figs. 23, 24 and 25 in the 1928 report correspond respectively with Figs. 12, 13 and 14 in the 1926 report. Fig. 22, in the 1928 report duplicates Fig. 22 in the 1923 report.

(1) Suspension and belt tension device.
(2) Generator pulley.
(b) Terminal block.
(1) On generator.
(2) On car body.
(c) Axle pulley and bushing.
(d) Belt and fasteners.
(e) Generator regulator (with corner brackets).
(f) Lamp voltage regulator (with corner brackets).
(g) Distribution panel.

Note: Any item not desired shall be crossed out.

II. Axle Generator

3. *Capacity*—(a) These axle generators are intended for service on cars having a total load, lamps, fans, etc., of . . . . . amperes at 32 volts. Each car will be equipped with . . . . . cells of battery of . . . . . ampere hours capacity.

Note: The railroad company shall specify whether the lead-acid-lead or nickel-alkali-iron battery will be used.

(b) The generator shall carry full load at . . . . . r.p.m.

Note: Capacities and sizes of axle generators recommended for the several classes of service are as given in the tabulations:

Class of Service	Net capacity of generator at 40 volts			Approximate maximum amperes load demand, exclusive of battery charging current	Ampere hour capacity of battery	
	Amp.	Kw.	R.P.M. Full Load		Min.	Max.
Official, sleeping, parlor, mail and dining. Heavy lighting load or severe operating condition....	125 100	5 4	675 21 or 550	63 50	350	600
Mail and dining cars. Lighting load not heavy and operating conditions not severe.....	75	3	450 or 750	35	300	350
Coaches, passenger baggage, baggage, etc., average operating conditions.....	50 35	2 1½	400 425	25 18	200 150	300 225
Coaches, passenger baggage, etc., in slow speed branch line or local service.....	50	2	400	25	150	225

(c) The generator shall be designed to generate rated voltage (40 volts) at load side of generator regulator and to carry full load, ... amperes (net current capacity, that is, total current generated, less all field, control and regulating current used in the generator, generator regulator and lamp voltage regulator), at an armature speed not to exceed . . . . . r.p.m.

(d) The generator shall be safe to operate both electrically and mechanically at an armature r.p.m. of 2500.

This value shall be known as the "Maximum speed" in r.p.m. of the generator.

(e) At all speeds from cutting in to maximum speed, and at all loads from zero to full rated net ampere capacity, the generator shall operate without destructive or excessive sparking at the brushes, and the armature and armature pulley shall rotate in good mechanical balance.

(f) The generator shall be capable of delivering rated net amperes within a range of 37 to 48 volts. (This requirement is not intended to conflict with the heat test.)

4. *Net Ampere Capacity*—The generator shall have a net ampere capacity of . . . . . amperes. For recommended values see Section 3-b.

5. *Frame*—(a) The axle generator suspension lugs shall be of such design and cross section as to eliminate, as far as possible, liability to blow holes, bubbles or other manufacturing defects which may tend to weaken the material in the lug or section of frame adjacent to the lug. The holes in the lug shall not be cored. The design and location of the lug shall be approved by the railroad company. Where there is movement of suspension links or pins in the lugs, the hole in the lug shall be suitably bushed, the bushing being placed in the lug in such manner that it cannot be lost or move relative to the lug. In the case of truck suspended generators, the foot clamp shall be secured by through bolts instead of capscrews.

(b) The generator frame, pole pieces and end housings shall be machined so that all are in accurate alignment and interchangeable from one generator to another of the same make, size and type.

(c) The end housing shall have one or more circular U-shaped grooves machined in the bore through which the shaft passes. Felt washers, fitting the shaft snugly, shall be applied to the inner side of the commutator end housing and to both sides of the pulley end housing.

6. *Field Coils*—(a) The field coils shall be wound with copper, insulated, preferably with the Class "B" insulation of the American Institute of Electrical Engineers.

(b) The field coils shall be form wound, impregnated with a suitable insulating compound to conform to established practices of electrical manufacturers, or thoroughly saturated by the dipping process with insulating material and then baked. The coils shall be covered with at least two layers of insulating tape laid with a half lap. The ends of each coil shall be marked to indicate the inner and outer ends of the coil. The coil shall be placed over the pole pieces and so held as to prevent positively any relative movement of the coil with respect to the pole piece.

7. *Armature*—(a) The armature, as a whole, shall be designed as a unit to permit the ready renewal of the shaft without disturbing any part of the winding.

(b) The armature conductors shall be of copper, insulated, preferably with American Institute of Electrical Engineers Class "B" insulation. Conductors shall be held securely in the slots.

(c) The commutator shall be of the non-ventilated type. The commutator bars shall be hard-drawn, drop froged or cast-swedged copper with solid risers made in one piece. The insulation between bars shall be high grade mica of such design and quality as will wear at the same rate as the bars. The commutator bars shall be insulated from the shell by built-up forms of high grade mica.

(d) The commutator shall be thoroughly seasoned, securely fastened on the shell, and assembled from the front.

(e) The armature shaft shall be annealed carbon steel having characteristics equal to or better than the following:

Carbon	0.38 to 0.52 per cent
Manganese	0.40 to 0.75 per cent
Phosphorus (not more than)	0.05 per cent
Sulphur (not more than)	0.05 per cent
Tensile strength, lb. per sq. in. (not less than)	80,000
Yield point, lb. per sq. in. (not less than)	0.5 tensile strength
Elongation in 2 in., per cent Inverse ratio	1,800,000—tensile strength
Elongation in 2 in. (not less than)	20 per cent
Reduction in area (not less than)	32 per cent
Reduction in area, per cent Inverse ratio	2,800,000—tensile strength

If higher grade material is desired chrome nickel steel is recommended.)

(f) The armature shaft at the fit for the inner race of the ball bearings shall be accurately ground.

(g) The armature shaft for all axle generators at the pulley fit shall conform to the dimensions shown on Fig. 22.

(h) The armature shaft pulley nut shall be of the . . . . . locking nut type. The face of the nut adjacent to the hub of the pulley shall be finished square with the axis of the thread.

8. *Bearings*—(a) Bearings used shall be of the annular ball type and size shall not be less than No. 412.

(b) One end bearing shall be so mounted that the bearing shall have approximately 0.01 in. play in the longitudinal direction of the shaft. The other end bearing shall be so mounted that it shall have at least 1/16 in. play in the longitudinal direction of the shaft.

9. *Armature Pulley Seat*—The pulley seat and key way of the armature shaft shall be in accordance with the dimensions as shown on Fig. 22.*

10. *Air Gap Clearance*—The mechanical clearance in the air gap shall be such that an oval feeler ½ in. wide and 0.05 in. thick can be passed at all points between the armature and pole faces.

11. *Leads and Terminal Block*—(a) Main generator and field leads shall be not less than 40. in long and shall consist of No. 2 A.W.G. cable of not less than 61 strands, with 30 per cent. Para rubber insulation, or equivalent, covered with 60 per cent. Para rubber.

(b) Generator terminal block, if used, shall be of design approved by the Railroad.

12. *Pole Changer*—The pole changer shall be of such design as to throw completely, from one position to the other, in not more than ten revolutions of the armature shaft.

13. *Generator Fuses*—(a) The positive armature lead shall have fuse contacts suitable for a 150-ampere knife blade N. E. Code fuse, with a 4 in. clearance space between contacts and of a design which permits removal of the contacts without disturbing the panel, as shown on Fig. 23.* Fuse holder to receive link fuse as shown on Fig. 18.*

(b) The use of a fuse in the field circuit is optional. If used, the contacts shall be suitable for a 0 to 30 ampere, ferrule type, N. E. Code fuse, with 1 in. clear space between contacts as shown on Fig. 25.*

(c) All fuses on cars shall be used in the locations and shall conform to the dimensions as shown on Figs. 13, 15, 17 and 24.*

(d) The capacity of the fuses used in the above contacts shall be such as to protect the apparatus in question.

14. *Badge Plate*—A badge plate shall be securely attached to each axle generator and shall show the following:
(a) Manufacturer's name.
(b) Manufacturer's type and serial number.
(c) Nominal voltage of generator (40 volts for 32 volt system).
(d) Rating in amperes.
(e) Minimum full load speed in r.p.m.

Generator Tests

15. *Method of Testing to Verify Rating*—(a) The generator, together with the generator and lamp regulators if used, shall be connected in a normal manner to dead load resistance in the battery and lamp circuit.

(b) It shall be operated continuously for five hours, with commutator hand-hole covers removed, at the minimum r.p.m. that will generate rated volts at the load side of the generator regulator and carry the current.

(c) When connected and operated as above, the generator shall carry its rated load without exceeding the following temperature values, measured by the thermometer method.

Insulation A. I. E. E. Classification

Part of Apparatus	Class "A" Maximum Observable Temperature Degrees C	Class "A" Maximum Observable Rise in Temperature Degrees C	Class "B" Maximum Observable Temperature Degrees C	Class "B" Maximum Observable Rise in Temperature Degrees C
Any part of generator regulator, except resistance units, carbon piles, commutator, brushes, brush rigging and bare copper solenoids.....	90	65	110	85
Commutator, brushes, brush rigging and bare copper solenoids.....	115	90	115	90

(d) Bearings—Maximum observable temperance 65 deg. C.

16. *High Speed Test*—Immediately after the above heat test, the generator shall be operated continuously for fifteen minutes at a speed of 2,500 r.p.m., with covers off, and shall perform satisfactorily, both electrically and mechanically, within the above specified heat limits.

17. *Ambient Temperature*—The complete test shall be made at or above 15 deg. C. ambient temperature.

18. *Insulation Test*—Immediately after the above tests all parts of the equipment shall withstand, without breakdown, an alternating potential of 1000 volts, applied between conductors and ground, for a period of one minute, all metallic parts except conductors being grounded. In addition, the generator shall be operated for 5 minutes at such speed and excitation as will induce five times normal voltage in the armature. Field coils shall be subjected for five minutes to an alternating potential between terminals of 20 times their maximum operating potential.

19. *Suspension*—(a) The generators shall be . . . . . suspended. (The Railroad Company shall insert "truck" or "body."

(b) All supporting parts subject to wear shall have the wearing surfaces bushed.

(c) Safety chains or equivalent construction, if used, shall safely support the generator in case of failure of the suspension.

(d) The suspension shall be in accordance with the following drawings of the railroad, which are hereby made a part of this specification, or they may be in accordance with the manufacturers' standard if the railroad company so elects. (List drawings or cross out section applying to same.)

20. *Belt Tension Device*—The belt tension device shall be in accordance with the following drawings of the railroad, which are hereby made a part of this specification, or they may be in accordance with the manufacturers' standard if the railroad company so elects. (List drawings or cross out section applying to same.)

21. *Generator Pulley*—The generator pulley shall be in accordance with Figs. 1, 2, 3 or 4.

III. Car Body Terminal Block

22. *Terminal Block*—(a) The terminals and lugs shall be solidly mounted on a suitable insulating base. Provision shall be made so that, in the event of disconnection, the leads cannot be improperly re-connected.

(b) If desired by the railroad, the terminal block shall be enclosed in a suitable housing of waterproof constuction. Provision shall be made for securely fastening to this housing the conduit carrying the outgoing conductors and canvas hose, if used, carrying the incoming conductors.

IV. Axle Pulley and Bushing

23. *Axle Pulley*—(a) A straight pulley seat shall be provided for the axle pulley.

(b) The axle pulley shall be . . . . . inches in diameter. (This diameter shall be as great as the construction of the car will permit with proper clearance, preferably twenty-one inches.)

(c) The hub of the axle pulley shall have a uniform internal diameter of seven and one-half inches. The length of the hub shall not be less than six and one-half inches.

24. *Axle Pulley Bushing*—The bushing, when used, shall preferably be secured to the axle by the clamping action of the pulley, shall have an external diameter throughout its length of seven and one-half inches and shall not be less than eight and one-half inches in length.

V. Belting and Belt Fasteners

25. *Belting* shall be . . . . . (Frictioned or rubber covered) . . . . . inches wide, ... plies thick or shall be in accordance with specification No. . . . . of the railroad. Belting to the total amount of . . . . . feet shall be furnished

26. *Belt Fasteners* shall be of the . . . . . type, suitable for the size of belting on which they are to be used.

VI. Generator Regulator

27. *Generator Regulator*—(a) The generator regulator panel shall be composed of a non-conducting, non-combustible material having a horizontal dimension of 16 in. and a thickness of one inch or more.

(b) The panel shall have four holes drilled in same for the supporting bolts. These holes shall be 7/16 in. in diameter and located 1 in. from the side and 1 in. from the ends of the panel, giving a horizontal distance, center to center of these holes, of 14 in. (Should it be desired to use a corner bracket with the panel, same shall have the supporting bolt holes drilled 7/16 in. in diameter and so located that when mounted on the panel the horizontal distance between center of holes is 14 in. For attachment to the panel the corner bracket shall be drilled and tapped for a ⅜ in. bolt having 16 threads per in.)

(c) The terminals on the generator regulator panel shall be arranged so that, in a horizontal direction, the positive is at the right and in a vertical direction the positive is at the top.

(d) Each terminal shall be stamped for identification and polarity.

(e) There shall be included with the generator regulato panel, wire terminals for attachment of the wires to the panel terminals; these wire terminals being stamped to correspond to the panel terminals to which they are to be connected.

(f) The apparatus shall be so mounted on the panel that it may be removed and eapplied without it being necessary to remove the panel from its supports.

(g) The connections between the various pieces of apparatus on the panel shall be, so far as is possible, on the back of the panel and soldered.

(h) The panel shall be supported by four ⅜ in. bolts having 16 threads per inch.

(i) Fuses, fuse contacts and fuse holders shall conform to Figs. 17 and 24* for fuses, Figs. 23 and 25* for fuse contacts, and Fig. 18* for fuse holder.

(j) The automatic switch shall be adjusted to close at not more than ½ volt above battery voltage.

(k) The automatic switch must open and close without chattering, pumping, sticking or excessive arcing.

(l) The generator regulating apparatus and battery protective devices shall be of such design as to perform satisfactorily all of the following functions:

1. Close and open the main circuit of the generator by means of an automatic switch, in order to permit current to flow from the generator to the battery and lamps whenever the generator develops proper voltage.
2. Automatically prevent the overloading of the generator.
3. Automatically control the rate of battery charge.
4. Automatically prevent overcharging the battery.
5. In case of open battery circuit, the generator shall be able to carry the lamp load and the generator regulator shall automatically prevent a rise in voltage greater than 5 per cent. of the generator regulator setting.
6. Means shall be provided whereby the adjustment of the regulator can readily be changed from the voltage and current suitable for a lead-acid-lead battery to the voltage and current suitable for a nickel-alkali-iron battery. The regulator being capable of being adjusted to give from 37 to 48 volts, such adjustment not to change more than ½ volt due to variations in temperature of voltage coil.
7. For any given condition of battery with any variations of speed from minimum full load speed to 2500 r.p.m. the regulator shall maintain regulation within 5 per cent., plus or minus, of the value for whch the regulator is set for operation. This value shall apply equally whether the type of regulation is potential, current, watts or any combination of same.
8. When submitting proposition, the axle generator manufacturers shall describe in detail the type of contol of generator output and battery charging that they propose to furnish, submitting such curves as are necessary to afford a complete explanation.

Note: Railroads may substitute for section 6-1 detailed specifications covering such type or types of regulation as they desire to consider, provided that the limits are not greater than those given in this specification.

[The seventh and eighth sections of the appendix are respectively entitled "Lamp Regulators" and "Rejection, Guarantee, Shipment, etc." Their contents are essentially the same as material included in the report adopted in 1920, and they are, therefore, not included in this abstract.]

The report is signed by W. E. Dunham (chairman), superintendent car department, Chicago & North Western; J. L. Minick, assistant engineer, Pennsylvania; E. Wanamaker, electrical engineer, Chicago, Rock Island & Pacific; E. W. Jansen, electrical engineer, Illinois Central; A. E. Voigt, engineer car lighting, Atchison, Topeka & Santa Fe; E. Lunn, electrical engineer, The Pullman Company, and H. A. Currie, assistant electrical engineer, New York Central.

Discussion

A. E. Voigt (A. T. & S. F.): The Boston and Maine has adopted the 32 volt system on account of the desirability of interchange of such cars with other trains. On the other hand, the Rock Island is using a 64-volt system on suburban trains. The only question that has come up, pertaining to the subject, has been with regard to which voltage would prove most desirable. The Association of Railway Electric Engineers, at its last meeting recommended, where it was practical, to hold to 32 volts. On exceptionally long trains this means the use of heavier copper in order to cut down the drop, but both voltages are used successfully by various railroads.

Chairman Smart: We can all realize the economy effected if we could do something like this and get away from generator and belt troubles. The belt trouble is one of the most serious things we have to contend with. What about doing away with batteries or smaller sets of batteries if you can go to the head end system?

H. H. Harvey, (C. B. & Q.): The Burlington has for many years lighted its suburban trains with the head end system, and with good success. We handle 10 and 11 cars, with no trouble at all. We use no batteries. The head end system is used on some of our lighter branch trains with no batteries, with good success.

L. E. Richardson, (B. & M.): We have a number of suburban trains lighted from the head end, 32 volts. It costs just a fraction of the cost of train lighting with the generator and the battery. The only trouble is when you come to interchange with other roads. As a matter of fact, we ran an excursion to Montreal last summer and had to send the engine all the way through because it had a head end lighting generator on it.

Prepared Discussion by G. S. Goodwin

G. S. Goodwin (C. R. I. & P.): Locomotive train lighting on the Rock Island is at the present time limited to the lighting of suburban cars, but since practically every suburban train operating out of La Salle station, Chicago, is electrically lighted in this manner from train lighting turbo-generators mounted on the locomotive boilers and such definite savings have been accomplished through

this form of lighting in this type of service, a few facts concerning this installation are presented.

A series of 50 all-steel 70-ft. suburban coaches of the latest design were put into service out of Chicago the latter part of 1923 and at the same time the necessary motive power was equipped with a series of Pyle-National 7½-kw. train lighting turbo-generators furnishing 64 volts direct current to the train line and 32 volts alternating current from the same rotor element to the cab and headlight circuits of the engines.

There are at present 37 engines equipped with the 7½-kw. train lighting turbo-generator previously described, together, with the necessary train line cable, conduit engine and tender connectors and fusing. These generators are overcompounded in a way to build up generator voltage with increased load up to rated capacity, and so automatically compensate for line loss along the train line supply as cars are added or the electrical load increases. Thus, no cab control of the unit by the enginemen is required other than to open the steam throttle valve and shut down when through.

The train line cable throughout the entire electrical system is No. 00 B. & S. gauge flexible cable, with the same size for connectors between cars as to current capacity, but of extra flexible construction to take up vibration and train weaving at these points. All inter-car connectors are supported by train line support springs from off the end of the car roof. These are so arranged as to be carried as a part of the car equipment, and fastened permanently in place. The connector support clamp is unhooked from the spring supports when a car is parted and the connector removed.

For passing current from the rear of the tender to the first car in the train, or from the smokebox to the first car when in back-up service, a length of extra flexible connector cable is sweated to the train line cable from the generator at a point just outside the outlet of the conduit run. The other end of the length of the connector cable has a two-pole plug for insertion into the three-wire connector receptacle of the first car, which plug rides in a dummy receptacle at the back of the tank when not in use.

The three-wire equal-potential system for the train line supply through the train provides practically normal voltage at each car distribution panel as operated in conjunction with the overcompounded train lighting generator on the engine. A return loop contact for this system is always available at the rear of the train since all three-wire connector receptacles are so arranged that the automatic loop switch built into them closes at all times unless a connector plug is inserted. As a connector plug is inserted at every receptacle except at the rear platform of the last car, when a train is in normal coupling, the rear loop is maintained.

All of the Rock Island suburban coaches are supplied with current at 64 volts to take advantage of the smaller train line cable and lesser line voltage drop made possible at the higher voltage. For emergency interchange service, where a suburban car may be required to operate on a main line train which is normally lighted throughout from axle-generator sets, all car circuit lamps operate at 32-volts. In the latest equipment the normal lighting circuits are permanently wired with lamps in series-parallel, that is, with all 32-volt lamps in the normal circuits permanently in pairs, dividing the 64-volt supply in two at each lamp pair. In the first 50 cars, this series-parallel arrangement was carried out throughout the entire car by circuits complete instead of by lamp pairs only. With this arrangement, a contactor system at the control panel places all the lamps in parallel for any excitation of the contactor relays at under 38 volts, but in series parallel at higher voltages.

While suburban coaches seldom, if ever, are called on to operate in main line trains, the electrical equipment allows train-lining to the adjacent axle-generator cars and supply from them during the period of special operation, or in cases of shorter main line runs, the operation of the small storage battery sets on straight discharge. If main line motive power were equipped for this form of head-end lighting, the supply could be brought back through the No. 2 wire train lines of the axle equipments to the one or two suburban cars trailing on the end, but at no time has this been found necessary, the present arrangement being entirely satisfactory.

In the case of all later types of suburban cars, the circuit for lighting while on a 32-volt supply is independent of the normal side-deck lighting units which are supplied at all times by 64-volt current. The 32-volt lighting circuit consists of six center deck ceiling units at 50 watts each for the car interior and a platform light at each end. With the greater lumens per watt output of illumination of these 50-watt lamps over the 25-watt side deck lamps, ample illumination is available whenever required. This center deck lighting is used only when in a station shed without a locomotive attached or when train lined to an axle-generator equipped coach in main line service.

Each coach carries a 60-ampere-hour pasted plate lead battery of 16 cells, primarily installed for current supply to the thermostat heat control system which is installed in each car. While a battery of this capacity is not required for the heat control, it was found best to increase battery capacity somewhat over that required for the heat control and so make available an emergency source of battery current for the lighting circuits.

Under normal operation the emergency lighting circuits operating off the battery sets are never called on, but La Salle station is an exceedingly crowded terminal and there come times every day or two when it is impossible to place an engine on the train for passenger loading and lighting at that time, the engine perhaps being coupled on the train only a minute or two before leaving time. Investigation of this situation discloses the fact that of all the many other railroads using the locomotive train lighting system for suburban service, their terminal facilities are such that the engine which pulls the train is always backed down with it, which guarantees a source of current for passenger loading and eliminates the need for a battery auxiliary, except where interchange might take place. No doubt, an expansion of the terminal facilities at La Salle station would allow us to improve on this phase of the locomotive train lighting installation, but in spite of any limitations, we find many economies in favor of this method and a steady flow of current regardless of train stops which gives an exceptionally pleasing illumination.

Having briefly described the electrical installation, some characteristics which make locomotive train lighting in Rock Island suburban service economical and desirable might be mentioned.

One of the problems confronting the designer of modern suburban cars is to produce a light-weight car which will better the ratio of weight per passenger hauled over that which has existed in the past, or in other words to carry more passengers for an ever increasing business with no more expendi-

ture for motive power than possible. Along this line, the roller bearing of the car trucks have done much toward helping the situation. With this in mind, to hold down the weight of electrical equipment is essential.

If axle-generator equipment similar to our standard applications had been applied to suburban cars, We find that weight of the more important elements of the electrical equipment would be much as follows:

Generator, with suspension and drive	660 lb.
Automatic switch, and field and lamp regulators	230 lb.
300 ampere-hour Plante plate lead battery	2,600 lb.
Weight per car	3,500 lb.
Weight per train (average, six cars)	21,000 lb.
Weight per train (maximum, eight cars)	28,000 lb.

As against the weights which must be hauled around with the axle-generator equipment, the following pertains now with respect to the application of locomotive train lighting equipment:

Generator on engine with conduit and wire mounting	850 lb.
(a) Generator weight per car (six cars)	141 lb.
Generator weight per car (eight cars maximum)	106 lb.
(b) Panel control equipment at car	20 lb.
(c) 60-ampere hour Plante plate lead battery	320 lb.
Additional weight train line equipment for locomotive train lighting over axle-generator train line equipment	230 lb.
(a + b + c) Weight per car (six car basis)	910 lb.
Weight per car (eight car maximum)	875 lb.
Weight per train (six car average)	6,000 lb.
Weight per train (eight car maximum)	7,000 lb.

Comparison of dead weights carried around chargeable to train lighting shows:

Saving in weight in favor of locomotive train lighting over axle-generator equipment—
Average train six cars..... 15,000 lb. or ⅓ of the axle-gen. wt.
Maximum of eight cars.... 21,000 lb. or about ¼ the axle-gen. wt.

In making cost comparisons, in terms of first costs, it is noted that in the case of the train lighting from the locomotive turbo-generator, the purchase of only one generator per train is required. As there must be extra engines equipped for emergencies and some in the shop, these must be considered on the basis of an average train of six cars. Therefore with 7 kw. of the turbo-generator going to the train the powerplant investment on a six car average train (in fact this also lights the 8 car maximum train) is on the basis of 7 kw. per train. In the case of the axle-generator, the smallest capacity considered in this slow speed service with frequent stops is about 2.6 kw. or, for an average train of six cars, a power charge for 15.6 kw. (for the maximum train of eight cars almost 21 kw.) per train.

In considering maintenance charges of the generation equipment, it is especially noted that this cost is little more than for the maintenance of the standard headlight generator. As the forces for headlight maintenance are well established already, giving headlight equipment frequent inspection and test, the amount of additional effort to inspect and maintain the larger 7½-kw. unit is little more as brought out by the fact that practically the same maintainance forces are handling the present train lighting equipment as required before for headlight work only.

This is, in a large measure, also true in the case of the cars on account of the simplicity of the car equipment. Only one regular maintainer is required at La Salle station to inspect all suburban equipment and keep it in running repairs, and he also looks after other terminal electrical work for the Rock Island. He receives some assistance from the car men as to placing connectors between cars when the trains are rearranged for some reason or other, but they handle this small amount of additional work in addition to the regular routine.

J. T. Tatum (B. & O.): Lighting the train from the locomotive is the beginning of a good undertaking. We do not need multiple electrical power plants on our trains to supply car lighting. Car lighting by the individual unit equipped to light each car has been satisfactory, as a beginning, but the facts remain that it has not given general satisfaction. We are having trouble with belts and the axle pulley. These should be eliminated. We are carrying considerable weight by independent car lighting equipment. That should be eliminated. The high cost caused by such independent units should be reduced.

Dining cars should be electrically refrigerated; trains should be electrically cooled—if no better method can be found—and we should have an electrical method of raising and lowering window sash. There is no reason why these should not be provided.

Mr. Voigt: The impression seems to have gone forth that we have gone wrong—that we should not have lighted our cars throughout all these years from the axle generator. The load on the suburban train is very different than that on a trans-continental train carrying Pullman cars and dining cars. The use of electrical power throughout a train is growing every day instead of decreasing, various phases of work being covered by the application of electricity—ventilation, refrigeration, heat control, curling irons, pressing irons, in some instances hot water heaters, and various apparatus added to the train for the comfort of the pasengers. If you think you can furnish all this power from the generator on the locomotive I think you will find that you are mistaken.

Locomotive end lighting has its field, and that is for suburban use, where cars are assigned and kept in such service, the same as the locomotive. Attempts to apply locomotive lighting to through trains, if you want to be in a position to utilize any locomotive available, would mean that all such locomotives must have a sufficient power plant to take care of the trainload—quite an expense — especially where you occasionally throw a freight engine onto a passenger train in an emergency.

Had head-end lighting been successful and satisfactory, in the past, it is not reasonable to assume that everybody would have departed from it. Should an attempt be made to send a sleeper or other cars over more than one road, such as the C. M. & St. P. & P., using a 64-volt system on head-end lighting, and the cars reach the Santa Fe, at Kansas City, over the Missouri Pacific or Alton in the dark, this would necessitate changing all the bulbs to 32 volts. You can rest assured that the passengers of that car certainly would appreciate such service after having ridden for a night or two in the dark.

It is not well to be swept off your feet by a use of locomotive lighting that is all right in its field but it has its field and it is limited.

Mr. Tatum: I do not agree with the speaker.

K. F. Nystrom, (C. M. St. P. & P.): Reference has been made to the head-end system on the Milwaukee as not being entirely satisfactory. That is true as far as interchange with foreign lines is concerned. We have been operating the system with turbo-generator in the baggage cars as standard for a number of years, 64 volts, and it is a more economical system than the axle lighting equipment. But we have, in the last year, obtained Pullman sleepers, having operated our own sleepers in the past. The Pullman sleepers have 32 volts. Our head-end equipment takes 64 volts and we had, therefore, to gradually change to axle light equipment.

If we had no interchange with foreign lines we would

not depart from the head-end equipment. We have been operating satisfactorily for a number of years our suburban cars in Chicago from the locomotive. We use both 32 and 64-volt turbo-generators satisfactorily. In the past we had oil as auxiliary lighting. We find that unnecessary and now have no auxiliary lighting at all.

Mr. Purcell: These head lighting system men can advocate this system, but there are two factors that have to be considered. These are cost and service. I will put the axle generator system against the head-end system on any railroad for cost and service.

Chairman Smart: The motion, is that this report be accepted, printed in our proceedings, the committee continue on with their work and to give consideration to head-end lighting, (cost, service and results, which includes all types of trains, both suburban and trans-continental) and that a vote of thanks be given to the committee for their work and for the discussion they brought out. (*The motion was seconded and carried*).

Memorial papers on the deaths of Alexander Kearney, formerly superintendent of motive power of the Norfolk & Western, and William F. M. Goss, were presented by R. L. Kleine and Harley A. Johnson, respectively. At the conclusion of each paper the members of the convention rose to their feet and stood a few seconds with bowed heads. The chairman then directed the memorials be printed in the proceedings and copies sent to the widows of the deceased—Editor.

The Rapid Development of Aviation

An estimate of the future trend based on present facts

By Major Clarence W. Young

Director of Aeronautics, Department of Commerce

Aviation has divided itself into three classes: Air transport, commercial air service, and private flying—each of which has its proper place in the general scheme of air transportation.

Air transport includes scheduled operations over fixed routes carrying mail, passengers and express. At present these operations are being maintained over approximately 12,000 miles of airways, each mile of which is traversed twice daily—some oftener—making a total daily mileage of about 30,000. This includes both night and day flying over all sorts of country, and on precise schedules.

Contract air mail has thus far constituted the major premise for this class of operation. It began with several minor contracts awarded to small organizations as far back as 1920, and reached a conclusive stage last November when the Post Office Department turned over the remaining portion of the transcontinental route to a private contractor, and retiring entirely from active operation and leaving the transportation of all air mail to private enterprise on a contract basis.

Thirty-three routes are now served in air transport operation; 22 are mail routes and 11 are passenger and other service. The former includes 17 separate contractors and the latter seven. Contracts for five other mail routes have recently been awarded and three additional ones are now being advertised. Requests for additional air mail service on new routes are numerous, and there seems no present indication that it will not continue to increase indefinitely. Also, there is existing authority for foreign air mail service and contracts for such service between Canada, Mexico, Panama and South America are more or less imminent.

The volume of air mail transported by private organizations during 1927 was 1,600,000 lb. The total income from that source was approximately $2,750,000. In this connection it is necessary to be mindful of the fact that the Post Office Department was still operating the Chicago-San Francisco portion of the transcontinental route until July and the Chicago-New York end until November.

The total poundage for the first four months of this year is 650,000, total income $1,350,000, with a substantial and constantly increasing tendency month by month, even with the existing rate of ten cents per half ounce.

Suitable records of express volume are not yet available; the contracts and service have been too recently inaugurated to permit the collection of much information. However, under a new air mail rate, five to ten cents, effective August 1, a pound of merchandise can be transported across the continent in 32 hrs. for $1.55, as compared with the existing rate of $3.20. It would seem to offer obvious possibilities.

Air transportation of passengers has been more or less incidental to air mail service, except in a few cases. During 1927, however, there were 8,500 passengers reported as carried on scheduled air transport, and it is not believed the reports are at all complete. This was largely accomplished during the latter part of the year because prior to July the Post Office Department was yet operating. the transcontinental route, and it carried no passengers. No reports of passenger volume are available thus far this year. There will undoubtedly be a marked increase, however, because of the comprehensive preparations being made for it. Several important passenger services are already being operated. Notable among them are the Stout line between Detroit and Cleveland, the Western Air Express between Los Angeles and San Francisco, the Maddux air lines between San Diego, Los Angeles and San Francisco, the Coast Line Route from San Francisco to Portland and Seattle and the Pan-American Airways from Key West to Havana. All of these companies are using tri-motored equipment. Also the Boeing Company, the air mail contractor between San Francisco and Chicago, has practically completed the construction of tri-motored planes with which to inaugurate a through passenger service between San Francisco and Chicago on a 24-hr. schedule. Three companies, at least, have announced a combined rail and air trans-continental service and others of a similar nature are under way, including a scheduled service to Mexico City. The two existing services between Los Angeles and San Francisco are of a keenly competitive nature, but business seems ample for both.

A question naturally arises—Are these companies showing a profit? What do their profit and loss statements say? It is a question not easily answered with definite figures. An attempt has been made to collect pertinent information in the premises, but it is not yet suitably available. From such reports as were submitted, however, it is decidedly apparent that a gratifying number of them are already deriving substantial returns, and that the others have reached a point where operating expenses are becoming consistent with existing revenues

and nothing seems to stand in the way of a financial condition that is entirely suitable. It is interesting to note that, of the companies reporting, the average operating cost was 67 cents per mile, but that for the companies admitting a profit, it was 54 cents per mile. It seems to indicate quite conclusively that operating efficiency and a minimum overhead are the major items in air transport as well as in any other enterprise, and that reasonable returns can be had even from present business volume.

Perhaps an indication of existing and anticipated conditions can be derived from the fact that while the Post Office Department is authorized to pay up to three dollars per pound for the transportation of mail over a given route, the present average contract rate is but $2.22. Competitive bidding on the part of private organizations has forced the rate down as low as 83 cents in one case, *i. e.,* Pueblo to Cheyenne; the New York-Chicago contract was awarded at $1.25 with a graduating scale downward, and the Chicago-San Francisco contact at $1.50 for the first thousand miles and 15 cents per one hundred miles thereafter. The bids in each case were submitted by organizations having suitable operating experience so it cannot be said they were arbitrary in character and not premised upon the probability of adequate returns.

Commercial Air Service

Commercial air service includes the so-called fixed-base operator engaged in taxi service, messenger service, commercial photography, mapping, sight seeing, touring, flying instruction, and other commercial operations. The largest amount of flying in the world is done in the United States in this class of operation, utilizing the airplanes of present day manufacture. From available records, it is estimated that 19,000,000 miles were covered in 1926. The 1927 records have not been compiled, but there will be a substantial increase because of the constantly increasing number of planes engaged in the service. Operating revenues are, of course, not known, but they are unquestionably enormous in the aggregate. Many hundreds of thousands of persons are taken on short rides, and the average fare per person will closely approximate $3.00. This class of business will continue indefinitely and in increasing volume. For many years there will be those who must take their first airplane ride, and it will be done locally in the majority of cases.

Private flying has developed remarkably in the last two years. Corporations and individuals are making comprehensive use of airplanes for both business and pleasure travel. It seems quite in order that it should be done because suitable equipment is available at comparatively reasonable initial and operating costs, a competent pilot can be trained for duties other than piloting, and enough time saved to more than offset any additional costs involved.

As an indication of the extent to which airplanes are being privately used—at the Louisville Derby this month there were 50 airplanes parked on the local field that had made the trip soley in connection with the races. There were as many more scheduled to arrive, but were forced to turn back because of the extremely unfavorable weather conditions prevailing in the vicinity at the time.

The aircraft manufacturing industry presents a rather unique situation. There are approximately 170 organizations—groups or individuals holding themselves forth as manufacturers of airplanes—and a goodly number of them are actually producing. Notwithstanding this, however, there is a demand for aircraft that cannot be supplied—the demand exceeds the supply. Many of these companies are, of course, inadequately financed and without suitable experience. Oothers are real organizations producing proven and approved equipment of various types. Production in several cases has reached five airplanes per day and increases are being provided for. One manufacturer's schedule calls for 10 per day and he will probably reach it during the summer. It can be conservatively estimated that 4,000 approved airplanes will be built during the current year, and that there is probably a market for twice that number were they available.

In May, 1926, Congress passed a law known as the Air Commerce Act 1926. It required the Secretary of Commerce to regulate and promote commercial aviation, to set up authority to license aircraft and pilots, to establish and maintain airways, develop aids to air navigation, and generally to do all things required in the premises.

There are two outstanding items involved: First, the determination of airworthiness of aircraft and competency of pilots, and their consequent licensing; and second, the establishment and maintenance of airways.

The former is a complicated and difficult one. However, it is working itself out in a satisfactory manner and is proving to be a real benefit, not only to the users of air transportation but to the industry as well.

Thus far, the Department has approved 40 types of commercial airplanes being produced by 24 manufacturers. The remainder of the 170 manufacturers are being, or will be, investigated in due course and appropriate action taken.

An indication of the comprehensiveness of present-day operation is derived by the fact that we have received since March, last year, 4,328 applications for aircraft licenses, 1,528 for identification marks, 5,004 for pilots and 4,392 for mechanics. This does not include 2,952 applications for student permits, 800 of which were issued by the Department during last month alone.

An airway is briefly described as a fixed route along which needed or available air navigation aids have been placed and over which scheduled operations are maintained. The air navigation aids include beacon lights spaced about 10 miles apart, intermediate fields at intervals of 25 or 30 miles equipped with beacon lights, boundary markers, obstruction lights, etc., as well as weather reporting service, radio communication and attendants.

Airways are laid out over the best flying country available along the route, due regard of course being given to the shortest distance. At the present time there are approximately 12,500 miles of established airways, 7,500 miles of which have thus far been lighted and completely equipped with the various available aids to air navigation. Four thousand additional miles will be lighted and equipped during the ensuing fiscal year. The cost of constructing airways under the present plan is approximately $318 per mile, and the annual maintenance cost thereof $195 per mile. It means that a total of $4,150-000 has been made available for maintenance and construction of airways during the fiscal year 1929 and that it will be a constantly increasing amount as additional airways are constructed and maintained.

In the establishment of new airways, it has been the policy of the Department to follow air mail routes as contracted for by the Post Office Department. However, it is entirely possible under the Air Commerce Act to establish airways for the purpose of operations other than for air mail purposes, provided the operating circumstances are such as to justify it.

All airways are under the control of the Department of Commerce and are maintained by appropriations from federal funds. The program for their continued construction and maintenance is a comprehensive one, and will be carried forward in the same proportion that Congress makes the necessary appropriations. These airways are a government aid of untold value to aviation and are for use to the same extent and in the same manner as are the highways of the United States. They constitute the premise for an enlarged air transportation service that will be without an equal in the world, and it is safe to predict that practically every important industrial center in the country will be tied in to this aerial highway system within the next few years.

Aids to air navigation are being developed as rapidly as circumstances permit. Important among them at the present time are radio beacons, night lighting equipment, and more reliable altitude indicating devices. Attention is also being given to effective mufflers for engines and the elimination of aircraft noises. Suitable progress is being made and practical solutions are to be expected.

There are many other important things the Department is carrying forward, such as aiding in the establishment and construction of airports throughout the country, dissemination of pertinent information, preparation of airways maps, testing of aircraft engines, etc., but time does not permit a more extended discussion of them here.

Future Trend

The aircraft manufacturing industry will, of course, undergo a substantial change. Many of the lesser companies will be eliminated in various ways. Consolidations will be effected, competition will take its toll, a lack of finances will play its part, and there will undoubtedly be re-enacted, but in less time, a repetition of the experience through which the automobile industry passed. The rule of the "survival of the fittest" will apply itself, and there should remain a comparatively few, highly specialized manufacturers, equipped to supply the demand of a discriminating market that will discuss aircraft as intelligently as it now does the locomotive, the steamship and the automobile.

A scheduled air transportation service with suitable equipment and personnel is not a "shoe-string" proposition. An adequate financial program is the first essential. Therefore, the operating organizations will be limited in number. They will be such as to create a demand for specialized development of equipment with constantly increasing efficiency, particularly adapted to the various requirements; also, they will be the means of making airport facilities available as and where wanted that can, if circumstances require it, be used exclusively by the operating organizations.

The apparent necessities would seem to indicate that there will probably be several large air transport companies which will ultimately control the long haul service. They may or may not be controlled by the railroad companies. It, of course, depends upon the action taken in the premises. Certainly, however, they will operate in co-operation with the various interested railroads and surely the through roads will need to be interested or a re-enactment of the motor coach situation will take place) either by contract arrangement of independent organizations or as separate organizations with interlocking ownership. Eventually, they will take over completely the transportation of mail and express as well as passengers. The time is not distant where through service from coast to coast over various routes with suitable intermediate stops, will be maintained. Meanwhile, a combined rail and air service is a certainty within a 48-hour schedule entirely practical. The volume of passenger business will depend entirely upon the facilities furnished and the capacity of the transport companies to handle it. There is a present demand for such a service as is evidenced by the experience of several air mail contractors who are attempting it incidentally.

Short Haul Contracts

There is a constantly increasing number of small organizations entering the field of air mail contract. When the new air mail rate becomes effective there will be many more routes established and many more companies will come in on the short-haul phase of it. Undoubtedly, there will eventually be a consolidation of the majority of these in order that suitable finances may become available and operating overheads reduced. It may be that they will be absorbed by one or more of the larger transport companies and constitute auxiliary services to the through routes. In any case, they wil do a tremendous volume of business. The Post Office Department estimates that the new rate will increase air mail volume by 25 per cent the first month, and that from 200 to 300 per cent the first year, with its consequent increase in the number of contractors, is conservative. Personally, I think the estimate is low because the service will be immediately extended to more industrial centers and thus open up a volume of business not heretofore available.

Fixed Base Operation or Commercial Air Service

Commercial air service operation offers real possibilities. At the present time it is a more or less disorganized and miscellaneous group throughout the United States. There are notable exceptions of course, but the average is not so good.

For the most part, they are small organizations or individuals operating light commercial planes. On many of the more important airports of the country, principally municipal, they are somewhat of a problem because of the large number, each competing with the other in carrying, taxi service, instructing, etc. Also, they are congesting the airports with their activities.

Other Than Private Flying

These three things represent the sum total of commercial operation. Air transport organizations on the through routes; short haul or feeder routes for mail, passengers and express; and fixed base operators whose volume of business is apparently unlimited if properly handled. Individually, these services seem to offer adequate certainties, and they are sufficiently interdependent that collectively they present an operating picture that is well worth consideration of capital capable of properly handling it.

Commercial aviation as we know it today is but two years old. Concurrently with the passage of the Air Commerce Act, there was the realization that our commercial aviation activities were disorganized and inefficiently handled. Immediately, there came into being an organized effort, using the pending air mail contracts as a premise to seriously undertake the profitable operation of aircraft for commercial purposes. This was followed by several outstanding aviation accomplishments, such as the Atlantic and Pacific crossings, which created an intense public interest in aviation and brought about a demand for air travel that had not previously existed—a demand that now exceeds available services. The progress during the two-year period has been remarkable. The experience gained has demonstrated that commercial

aviation is economically sound, and that the four essential elements in any successful transportation service—speed, reliability, cost and comfort—are rapidly being coordinated. The succeeding two years hold forth infinitely greater probabilities, and evidently it is the period during which the question of control, ownership, and management of the air transport service of the United States will be determined.

Report of Committee on Safety Appliances

Fifth schedule of air brake tests nearing completion at Purdue—One more, and then the road tests

By H. A. Johnson
Director of Research in Charge of Power Brake Investigation

H. A. Johnson

During the past year substantial progress has been made in the investigation of power brakes and appliances for operating power brake systems, which was started in 1925.

The program of rack tests, as agreed to at the start of this investigation by all interested parties, included four different brake equipments, namely, the standard Westinghouse type K brake, the Automatic Straight Air brake, the Westinghouse type FC-5 brake and the Westinghouse type FC-3 brake equipment. The rack tests on the first two of these equipments, the standard type K and the Automatic Straight Air brakes, have been completed and the rack tests on the third equipment, the Westinghouse type FC-5 brake, will be finished about July 1, 1928.

Table I shows the number of rack tests made on each of these equipments with the dates of starting and completion of each series of tests.

Table I—Tests So Far Completed

Equipment	Number of tests made	Tests started	Tests completed
100 Type K triple valves.	621	Nov. 30, 1925	June 30, 1926
100 Automatic Straight Air brakes	602	Aug. 17, 1926	April 6, 1927
Mixed equipments of 50 Type K and 50 A. S. A. brakes	188	April 25, 1927	July 20, 1927
100 Westinghouse Type FC-5 brakes	611	Sept. 27, 1927	Mar. 29, 1928
Mixed Equipments of 50 Type K and 50 Type FC-5 brakes	168	April 17, 1928	*July 1, 1928

*Estimated.

When the annual report, dated June, 1927, was prepared the mixed equipment tests, representing a 100-car train composed of 50 standard type K and 50 Automatic Straight Air equipments, were in progress. This series of tests was completed July 20, 1927. These equipments were then taken off the test rack and replaced with 100 sets of the new Westinghouse type FC-5 brakes which it was claimed by the manufacturer would meet all the tentative specifications and requirements of the Interstate Commerce Commission. After the installation was completed the test rack was turned over to the Westinghouse Air Brake Company so that they could make such preliminary tests and adjustments as they thought necessary to satisfy themselves that their equipment was ready for the official tests, which were started on September 27, 1927.

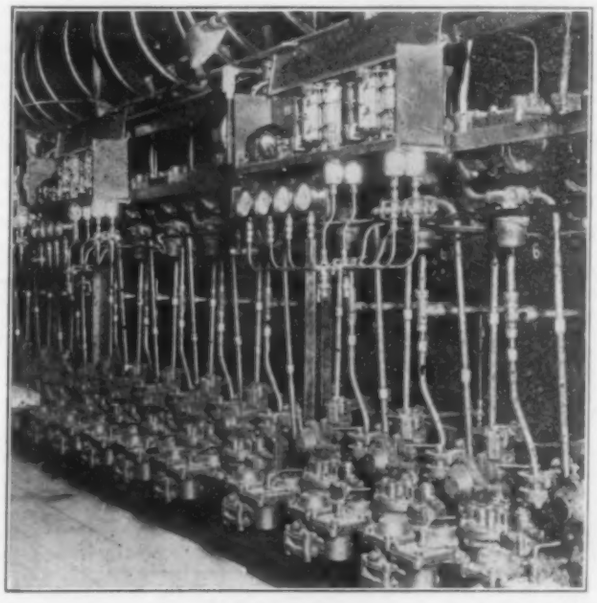
Westinghouse FC-5 Brakes Now on the Rack

The photograph shows the installation of a portion of the 100 sets of the Type FC-5 brake equipment on the test rack at Purdue University. This equipment, as submitted for this investigation, was developed for test purposes only, being made up of a number of portions and housings to aid in studying the various functions of the equipment and also to meet the space limitations of the test rack. If, however, this equipment was to be manufactured in commercial form, many of the portions and housings would be consolidated into a form most adaptable to the various types of freight cars.

Some of the distinctive features claimed for the FC-5 brake equipment are as follows:

1—Elimination of undesired quick action.
2—Emergency quick action available at any time with high emergency brake cylinder pressures.
3—Graduated release.
4—Maintenance of brake cylinder pressures against leakage within certain limits of time and pressure.
5—Compensation for variations in piston travel.
6—Detection of excessive brake cylinder leakage in direct release operation.

The series of tests made on the 100 sets of Westinghouse FC-5 brake equipment was completed March 29, 1928. Fifty of these equipments were then removed from the test rack and replaced with standard type K equipments in preparation for the mixed equipment tests. In the first half of the rack, from car No. 1 to 50 inclusive, the two kinds of equipment were alternated in groups of five cars each, with type K triple valves on cars No. 1 to 5, type FC-5 brakes on cars No. 6 to 10, and so on. In the rear half of the rack, from car No. 51 to 100 inclusive, the two equipments were in groups of 25 cars each, with type K triple valves on cars No. 51 to 75 and with type FC-5 brakes on cars No. 76 to 100. The test rack is so arranged that by changing a hose connection the train may be reversed, thus bringing



Portion of 100 Sets of Westinghouse FC-5 Brake Equipment on Test Rack at Purdue University

the group of 25 FC-5 brakes on the head end of the train and the group of 5 standard type K triple valves on the rear end of the train. These mixed tests were started April 17, 1928, and it is expected that they will be completed about July 1, 1928. The 50 standard type K brakes and 50 type FC-5 brakes will then be removed from the test rack and be replaced by 100 sets of the new Westinghouse type FC-3 brake.

Westinghouse FC-3 Tests Still To Be Run

Of the four brake equipments included in the program of rack tests, two equipments, namely, the Automatic Straight Air brake and the Westinghouse type FC-5 brake equipment, were designed to meet all the tentative specifications and requirements of the Interstate Commerce Commission. The Westinghouse type FC-3 brake equipment contains the ideas of the Westinghouse Company on the desirable functions of an air brake equipment for long freight trains and is submitted to the American Railway Association to further its investigation to determine what improved appliances or devices are available and what improve-

ments, if any, in power brakes and appliances may or should be made to the end that increased safety in train operation may obtain. The type FC-3 equipment does not provide for the maintenance of brake cylinder pressure against leakage nor for the graduated release of brake cylinder pressure which are two of the tentative requirements of the Commission.

Before any new brake equipment would be considered for adoption by the Association, it must be subjected to road tests to determine whether it meets actual service conditions in a safe and practical manner. When mixed in the same train with standard type K equipments it must operate in harmony with these standard equipments and it should also be designed so it will improve the operation of the train as a whole and not be detrimental to the operation of the standard brakes in the train. Upon completion of the rack tests and the thorough analyzation of their results, road tests will be conducted with such equipments as have shown sufficient merit during the progress of the rack tests. A tentative schedule of road tests is being drafted and upon completion will be submitted to all interested parties, including the Bureau of Safety of the Interstate Commerce Commission, the manufacturers, the Committee on Safety Appliances and the Committee on Brakes and Brake Equipment, for their criticisms and suggestions. Progress has also been made in the study of the proper instruments and equipment to be used in the road tests in order to obtain accurate information of the operation of the brake equipments and also of shock and slack action.

Railroad Visitors Welcomed

During the year the organization for making the tests in the power brake laboratory and for tabulating and analyzing the results has remained fairly constant at a total of 75 men. Representatives of the Bureau of Safety, Interstate Commerce Commission, and of the Westinghouse Air Brake Company have been present during the conduct of all tests and have made daily reports to respective headquarters covering their observations. The Director of Research has made semi-monthly progress reports to the Director of the Bureau of Safety of the Interstate Commerce Commission, copies of which are sent to R. H. Aishton, president of the American Railway Association; C. E. Chambers, chairman of the Committee on Safety Appliances, and V. R. Hawthorne, secretary of the Mechanical Division.

During the year a large number of representatives of railroads have visited the power brake laboratory and have taken considerable interest in the work. These visits are much appreciated by the staff carrying on the work and we hope their number will be increased.

(A motion to accept the report was seconded and carried.)

Report of Committee on Brakes and Brake Equipment

Analysis is made of paper on braking power presented at 1927 convention of the Air Brake Association

G. H. Wood
Chairman

The question of the application of two or more triple valve gaskets between triple valves and reservoirs on freight cars has been brought to the attention of this committee. The committee is of the opinion that the necessity for more than one gasket will be obviated by insuring that properly dimensioned studs are used in each instance. Where difficulty is experienced in making a tight joint, the studs should be checked to insure that the threaded portion will permit of the triple valve being drawn tightly to its seat with the application of a standard gasket. The committee strongly urges careful attention to this feature as a means of improving the service and effecting economy through the conservation of material.

Braking Power on Refrigerator Cars

The Committee has made a preliminary analysis of the points covered in the recommendations made by the Griffin Wheel Company to the Committee on Wheels. Also, it has investigated, in conjunction with a committee representing the Air Brake Association, some of the features in connection with train operation which were involved in a paper on the same subject, submitted by F. K. Vial and which was distributed generally among the railroads of the country. A copy of this joint committee's report to the Air Brake Association is appended to this report.*

Mr. Vial's paper is divided into three principal sections, i.e.: The present braking forces; record of damage to cast-iron wheels, and proposed remedy for the situation.

A careful analysis of this paper indicates that the tables and deductions used do not agree with the known facts regarding brake operation. The term braking power is in many instances confused with brake shoe pressure. Correctly speaking, braking power covers the ratio of the total brake shoe pressure to the car weight. This ratio is the controlling factor in all brake problems and since the maintenance of it at as uniform and constant a value as is possible is most desirable in handling long trains, it is evident that the brake shoe pressure must vary in proportion to the weight of the car in order to accomplish this.

Mr. Vial accepts the co-efficient of brake shoe friction as obtained on a testing machine as applicable to road conditions. The results obtained on a testing machine are higher than the corresponding results which are obtained in service and the particular tests used as a basis for developing the co-efficients of friction of brake shoes on freight cars were made on a testing machine under conditions which do not parallel those found in service and consequently give results which are much higher. The deductions arrived at, therefore, do not agree with ordinary service conditions. In Mr. Vial's analysis the efficiency of the foundation brake gear has been ignored and since it is well known that there is a certain loss in the transmission of force from the brake cylinder to the brake shoes the omission of this important factor renders his conclusions inaccurate and unreliable. The ordinary resistance to motion such as rolling, friction, curve resistance, etc., has been used by Mr. Vial in summing up the available forces which control trains. As a matter of fact it has always been understood in the air brake art that the use of such factors are misleading and it is the practice to eliminate them from consideration in figuring braking ratio.

These resistances are so variable that the average value cannot be used, only the minimum values might be depended upon and even these are not constant. It has always been assumed that the rolling friction was just about offset by the rotative effect of wheels and axles, and in view of this fact we do not agree with Mr. Vial in the propriety of considering these resistances as he has outlined them.

Loaded Weights Have Wide Variation

We do not agree with statements made in this paper that the maximum loaded weight is the normal condition of freight cars in service because, in checking a number of trains in actual

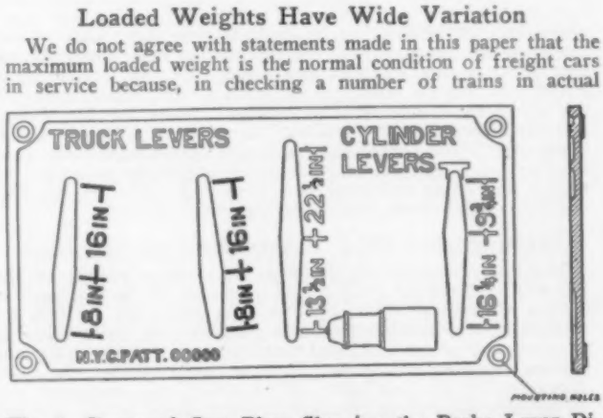


Fig. 1—Proposed Cast Plate Showing the Brake Lever Dimensions for Freight Cars with Combined Equipment

service, the make-up of which varied between wide limits, the lading varied from empty to a fully loaded car, these checks showing conclusively that any attempt to use the loaded weight of a car as a basis for figuring braking ratio is altogether untenable. We are at the present time without definite information

*An abstract of the joint committee's report was included in the report of the 1928 convention of the Air Brake Association, held at Detroit, Mich., May 1 to 4, inclusive, which was published in the May 5 issue of the RAILWAY AGE, page 1055. An abstract of Mr. Vial's paper was published in the November, 1927, Railway Mechanical Engineer,

as to the actual co-efficients of friction obtained on freight cars in road service and the basis for the co-efficients assumed by Mr. Vial are very erratic and we do not think can be used without information from actual service operation. We cannot, therefore, concur in Mr. Vial's statement with reference to the difference in the co-efficient between the cast-iron and steel wheel which he assumes.

Apparently Mr. Vial assumes that the braking ratio of the refrigerator cars is as much higher than that of other cars as their average weight is higher. This, however, is entirely wrong since the braking ratio of refrigerator cars is no higher than that of any of the others when they are braked in accordance with the present A. R. A. requirements. We do not agree to the suggestion for grouping freight cars according to their axle bearing load limits and taking the average empty weight of each of these groups as representing the entire group.

In discussing the raising of the brake pipe pressure from 70 to 90 lb. in grade service, Mr. Vial again confuses the increase in brake shoe pressure with that of braking ratio, and overlooks the fact that the increase of the latter is proportional for all classes and weights of cars. He also refers to irregularities in piston travel and to undesired quick action as having a bearing on the subject, whereas in reality no method of figuring the braking ratio of a car can have the slightest effect upon such irregularities.

Co-efficient of Friction for Cast Iron and Steel Wheels

We have previously alluded to the fact that an analysis of the tables given in Mr. Vial's paper do not warrant the claim of 25 per cent greater co-efficient of friction for cast-iron than for steel wheels, since the difference varies considerably. Furthermore, brake shoe tests have shown that a greater difference in th co-efficient of friction exists by the different kinds of brake shoes or, even with the same brake shoes under different conditions, than is claimed for the differences in these two types of wheels.

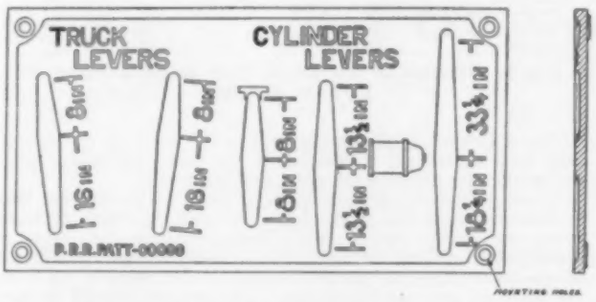


Fig. 2—Proposed Cast Plate Showing the Brake Lever Dimensions for Hopper Cars Having Detached Equipment

We are unable to see the consistency in Mr. Vial's conclusion that the braking force on a car may vary so much as 100 per cent above normal by using a factor based upon a light brake shoe pressure on light cars compared with the heaviest possible brake shoe pressure obtainable on the heaviest cars. It does not indicate the variation on any one particular car, nor between the cars composing any one train and it is, therefore, entirely aside from the subject discussed.

Mr. Vial quotes records to show that the greatest amount of damage to wheels due to high temperatures occur on cars of heavy tare weight, apparently referring particularly to refrigerator cars, and claims that the latter have a greater retarding force under equivalent conditions than the other cars in regular service. We have failed to substantiate this contention since there are many cars of other classes, such as gondola, hopper, automobile and tank cars, having just as great tare weight as any of the refrigerator cars and our investigation has disclosed that such cars have just as light loads with the same frequency as refrigerator cars and, therefore, the braking forces will be the same upon them as they are for refrigerator cars at such times. It is self evident that, since the brake shoe pressures are the same on all cars of a given tare weight, the cause for wheel damage and high temperatures is dependent on the weight or class of car involved and we would call attention to the fact that as far as generation of heat is concerned, those refrigerator cars which are classed among the 30- and 40-ton groups by their load-carrying capacity should really be classed among the 50- and 70-ton groups, so far as generation of heat is concerned. Consequently, the weight and heat dissipating capacity of wheels should be made to depend upon the empty weight of the car rather than on its load carrying capacity.

The investigations we have made in territory where the cars were subjected to the same conditions develop that the refrigerator cars develop no more wheel trouble than the other cars of the same weight.

Standardization of Brake Levers Now Impracticable

Mr. Vial recommends that brake levers be standardized and the proper levers stenciled on the side of the car. We agree with this recommendation in principle and would add that the same suggestion has been made in the past, but unfortunately, lever standardization is impracticable until such time as the construction of various classes of cars is standardized. This, however,

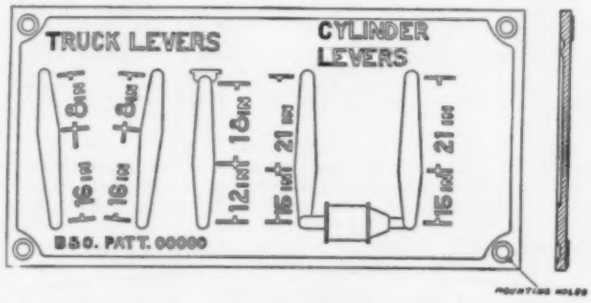
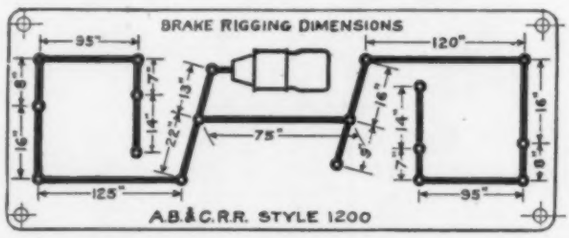


Fig. 3—Proposed Cast Plate Showing the Brake Lever Dimensions for Freight Cars with Detached Equipment

need not prevent some proper indication of the correct size of levers being applied to every car.

Mr. Vial's suggestion with reference to the method of establishing the braking ratio for various classes of cars would introduce greater irregularities in retarding force than is now common under present A. R. A. requirements. Since he recommends that the braking ratio be increased on cars below a certain weight and decreased on cars above that weight, treating them in groups according to the size of axle used.

In the course of our analysis of Mr. Vial's paper, we investigated the condition of the foundation brake gear on nearly 2,000 cars in order to ascertain what variations from standard braking ratio are regularly met with. We assumed that any car having both trucks braked between 57½ per cent minimum and 62½ per cent maximum with 50 lb. cylinder pressure was acceptable as standard. The results of this investigation made on cars in all parts of the country and taken at random in trains or yards, shows that out of the number investigated, two-thirds have the same braking ratio on both trucks and the other third had a wide range of difference between the two ends of the car. Of the total number of cars measured, 1,987, there were 494, or about 25 per cent, that came within the above assumed standard limits. All the rest varied from it either in the average for the car or in variation between trucks.



¼ ALUMINUM PLATE—DESIGN AND LETTERING TO BE ETCHED BLACK.

NOTE: LEVER DIMENSIONS, INITIALS OF RAILROAD AND STYLE NO. ARE SHOWN FOR ILLUSTRATIVE PURPOSES ONLY.

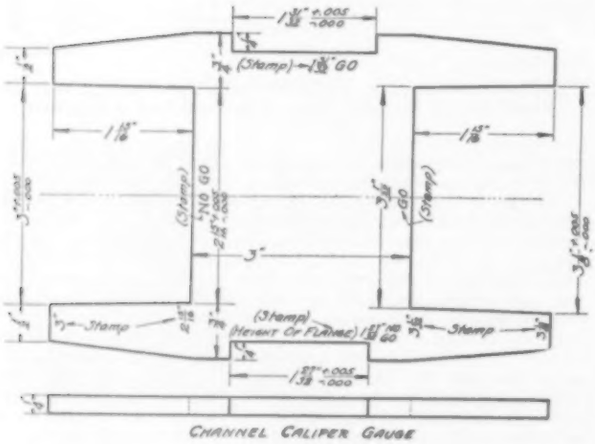
Fig. 4—Proposed Stamped Plate Showing the Brake Lever Dimensions for Freight Cars with Combined Equipment

Extremes of Erratic Braking Ratios Found on Freight Cars in General Interchange, Referred to Their Empty Weight

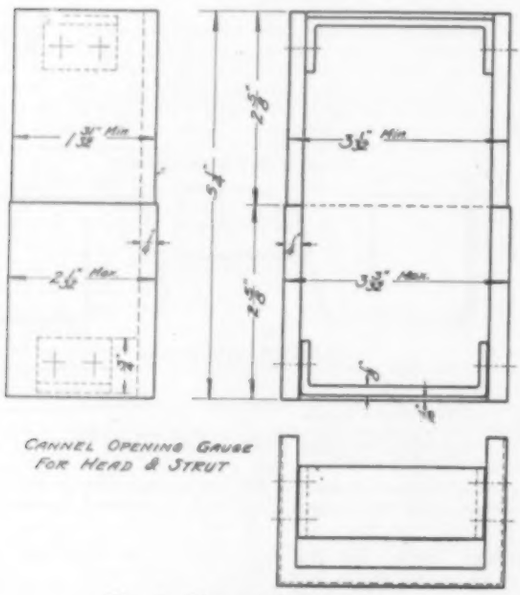
Per cent. Breaking Ratio, 50 lb. Cylinder Pessure,			Per cent. Breaking Ratio, 50 lb. Cylinder Pessure,		
A End	B End	Average	A End	B End	Average
86.3	113.0	99.6	50.5	103.5	77.0
103.8	60.6	82.4	131.3	129.4	130.3
105.8	97.5	101.3	125.8	126.5	126.1
109.0	53.0	81.0	144.0	152.3	148.1

Per cent. Breaking Ratio, 50 lb. Cylinder Pressure,			Per cent. Breaking Ratio, 50 lb. Cylinder Pressure,		
A End	B End	Average	A End	B End	Average
108.9	60.1	84.5	86.7	125.8	106.7
77.7	109.5	93.6	81.1	114.5	97.8
150.0	72.0	111.0	88.7	100.4	94.4
125.0	123.0	124.0	111.0	88.0	99.5
103.5	61.9	82.7	102.0	91.0	96.0
158.0	419.0	288.5	119.0	84.0	101.5
111.9	62.9	87.4	125.0	127.0	126.0
100.2	95.2	97.7	136.5	266.0	201.0
164.5	58.4	111.5	121.0	135.0	128.0
128.5	55.3	91.9	151.0	75.5	113.2
153.8	57.6	105.7	129.0	129.0	129.0
96.8	102.7	99.8	176.0	176.0	176.0
143.1	60.1	101.6	148.0	148.0	148.0
154.1	58.5	106.3	159.0	159.0	159.0
123.0	58.9	91.0	104.0	104.0	104.0
126.0	219.0	172.5	127.0	267.0	197.0
113.2	79.8	96.5	57.8	100.0	78.9
129.0	60.8	94.9	109.8	191.9	150.9
117.7	42.5	80.1	25.3	9.5	17.4
113.0	59.5	86.3	22.0	21.2	21.6
107.0	188.8	147.9	25.0	10.0	17.5
124.0	89.4	106.7	22.6	21.3	21.9
84.4	114.0	99.2			

In the table, the extremes found are given—those above 100 per cent and those below 30 per cent in order to show the tremendous variations that exist. The average for the car varies between 7.4 per cent and 288.5 per cent, or a difference of 281. From the standpoint of damage to wheels and brake shoes, each truck should be taken as a unit by itself. The greatest range between braking ratio on trucks was from 9.5 per cent to 419 per cent or a difference of nearly 410 per cent. Evidently, therefore, the present A. R. A. standard braking ratio for freight equipment is not being maintained on a very large number of cars in general interchange. In our judgment, this condition of brake gear, more than any other one cause, is responsible for a large percentage of damaged wheels, brake gear failures, bent brake beams, burned brake shoes and heads, break-in-twos and bad slack action in freight service. There is no use talking about adopting a new standard for braking ratio until we can find out what will happen when the present standard is properly maintained.



CHANNEL CALIPER GAUGE



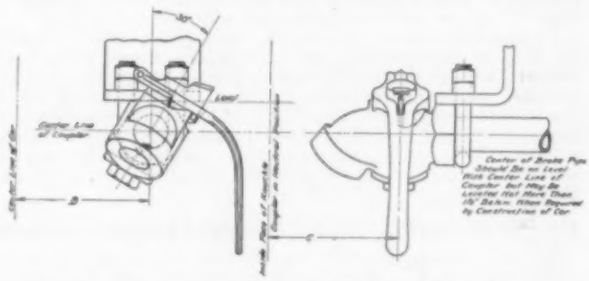
CANNEL OPENING GAUGE FOR HEAD & STRUT

Fig. 5—Channel Caliper Gage

Braking Ratio Recommendations

In view of these conditions we make the following recommendations:

First—That no variation in the braking ratio be allowed, due to the difference in the empty weights or carrying capacity of cars, since uniformity is obtained to the maximum degree when the empty cars all have the same braking ratio.



	B	C
Wooden Underframe Cars	13"	13"
Steel Underframe Cars Built after 1916	13"	9"
For New cars or cars bearing 3" Couplers	15¾"	8"

Fig. 6—Relation of the Brake Pipe Angle Cock to the Coupler Knuckle

Second—That no differential be adopted at the present time in braking ratios due to the materials used in wheels or brake shoes, nor in the future until definite constant differences in the frictional characteristics of those materials are determined. When such differences are determined, no reduction in the braking ratio of any car below that now standard should be permitted, the differential operating only to bring the lower frictional materials up to the standard of the highest.

Third—That a metallic plate, such as is illustrated in Figs. 1 to 4, be made a standard part of every car, fastened to the under frame in an accessible place, preferably near the brake cylinder, which shall contain in an indestructible form the proper dimensions of levers for both body and truck brake gear. And that when an approved form of badge plate is applied to any car, checking of the levers to see that they conform with the standard dimensions be made a part of the rules in effect on all railroads in governing annual repairs to brakes on freight cars and, if wrong levers are found, that they should be replaced with levers conforming to the dimensions shown on the badge plate.

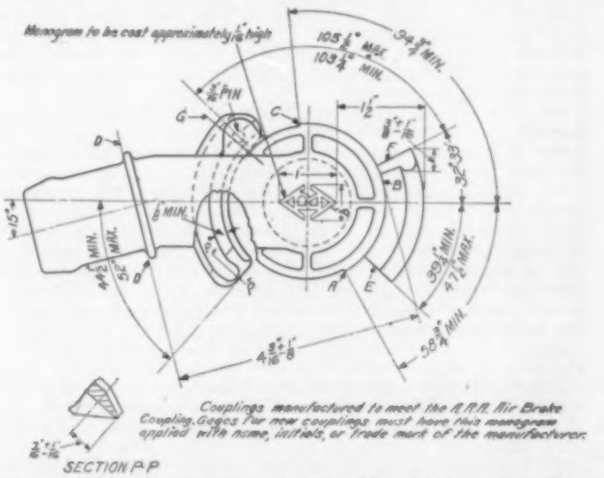

Monogram to be cast approximately ½" high
Couplings manufactured to meet the A.P.T. Air Brake Coupling Gages For new couplings must have this monogram applied with name, initials, or trade mark of the manufacturer.
SECTION P-P

Fig. 7—Recommended Gage for Checking Air-hose Couplings

Other Recommendations

Channel Caliper Gage—The committee recommends changing the brake beam channel caliper gage, shown on Page 11, Section B of the manual and substituting the drawing shown in Fig. 5. The channel caliper gage now standard necessitates truing up of the edges of cut channels in order to make proper use of the gage. The gage suggested permits of calipering the channel at any point throughout its length and is commonly used by the manufacturers.

Spring Type Retaining Valves—Referring to Circular No. DV-414, dated June 27, 1925, calling attention to the practice of stretching of springs in the spring type retaining valve, and the report of this committee at the last meeting in Montreal, in which we recommended a modification of specifications for the A. R. A. duplex spring type retaining valve. At this meeting we stated that the air brake companies were, at that time, developing a type of cap that could be substituted for the present caps in which provision would be made to prevent distortion of springs.

The development of this cap has now been completed and the

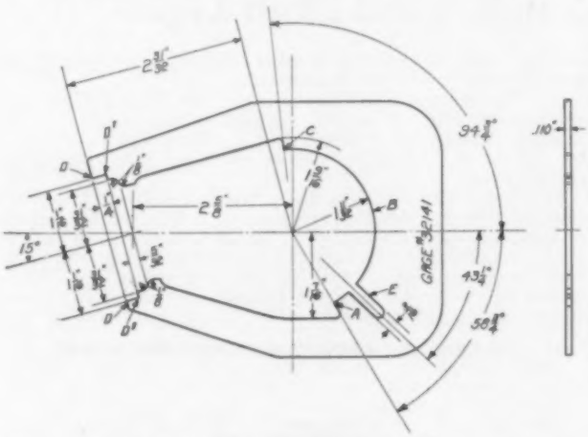


Fig. 8—Gage No. 32141 Recommended for Checking New Air-hose Couplings

air brake companies will include it with new valves without any additional cost and will supply it for repairs to existing valves at a slight additional cost.

Brake Leverage Ratio for Passenger Cars—It is important that the brake leverage ratio be maintained within certain limits in order to avoid undesirable false piston travel and to prevent the evils resulting therefrom. It has developed that there is a tendency to use leverage ratios in excess of that which is good practice. The committee, therefore, recommends as recommended practice the total brake leverage ratio for passenger cars having six-wheel trucks shall not exceed 8 to 1 and 9 to 1, respectively, with single-shoe and clasp-type truck brake gear.

Tolerances for Camber of Brake Beams—Reference was made in last year's report to the above subject and we now recommend as recommended practice a note added to the drawing on page 83-1926, Section E, of the Manual, providing for a tolerance of ⅛ in. plus or minus in the camber of brake beams.

Triple Valve Test Racks—We have, through the medium of a questionnaire, canvassed the extent to which the type 2-T triple-valve test racks are still in use, and find very few of this type rack now in service. We, therefore, recommend eliminating from the manual the assembly diagram of the No. 1 A. R. A. triple-valve test rack, which is indicated as Fig. T-1, thereby standardizing the No. 2 rack indicated as Fig. T-2, and that a leakage indicator be made a standard part thereof. Also that test racks conforming to the drawing indicated as Fig. T-1 be converted so as to conform to the drawing Fig. T-2. The effective date for such conversion to be not later than December 31, 1929.

Bushing Triple Valve Exhaust Ports—A question has been raised with reference to bushing exhaust ports in triple valve bodies. We recommend that exhaust ports requiring rebushing due to damaged threads or otherwise be increased not to exceed ½-in pipe size.

Steam and Air Connections for Passenger Cars—Pursuant to a request of the General Committee to prepare for submission to the members a letter ballot on steam heat equipment covering 2 in. metallic connections, 2-in. end valves and coupling with 2-in. openings, we recommend submitting to letter ballot for adoption as recommended practice, a revision of the last paragraph, page 77, Section E, of the Manual, to read as follows:

End valves shall have 2-in. openings; flexible metallic steam heat connections (preferably insulated), 2-in. inside diameters; 2-in. steam heat couplings with gaskets having 2-in. diameter openings, gaskets to be so constructed that the normal diameter of opening will always be maintained; inlet valves to have reduced openings which should be as small as possible and maintain the volume of steam required by the radiating pipes for the severest weather conditions.

Restoration of Pages Removed from the Manual of Standard and Recommended Practice—Page 8-1923 of the manual, which shows the position of the brake-pipe angle cock in relation to the coupler knuckle, was inadvertently eliminated from the manual some time ago. We recommend restoring this page as shown by Fig. 6. We also recommend the following revisions in page 7-1925, Section E, of the manual:

a—The words "high speed" to be stricken out of the caption and marginal heading.

b—Adding a new sentence as follows: "Maximum pressure in brake cylinder for figuring fiber stresses 100 lb. per square inch" between lines 2 and 3 under the heading Fundamentals of Design.

c—The words "is made" in first line, last paragraph, changed to "should be made."

Air Brake Hose Couplings and Gages—In the last year's report this committee recommended the adoption of a proposed standard A. R. A. monogram on brake pipe hose couplings, drawing of which was shown in that report. Since that time the question of dimensions covering certain features of the coupling have been gone over and we now recommend revising this drawing as shown in Fig. 7, which includes important dimensions that are considered desirable.

For the purpose of checking these dimensions on new couplings we recommend the adoption of the gages shown in Figs. 8 and 9, also that page 53-1926 of the manual, including instructions for the use of gages for checking new air brake hose couplings be revised to include the following instructions covering the use of the gages shown in Figs. 8 and 9:

1—Point *A* and *C* of gage No. 32141 establish minimum length of the finished surface *A B C* on the coupling.

2—Shoulder *D-D* on the coupling must fall between *D-D* and *D'-D'* on gage No. 32141.

3—End of lip *E* on the coupling must fall within the space *E* of gage No. 32141.

4—With pin *F* of gage No. 32142 contacting with the shoulder *E* on the coupling, edge *G* of the guard-arm pin must cause the gage arm to come within lines *H* and *H'*.

5—Sleeve *J* of gage No. 32142 is for gaging the position of the end of the guard arm.

Requirements for the Equipping of New Cars with Centrifugal Dirt Collectors—During the past year the committee recommended to the Arbitration Committee that a rule be inserted in

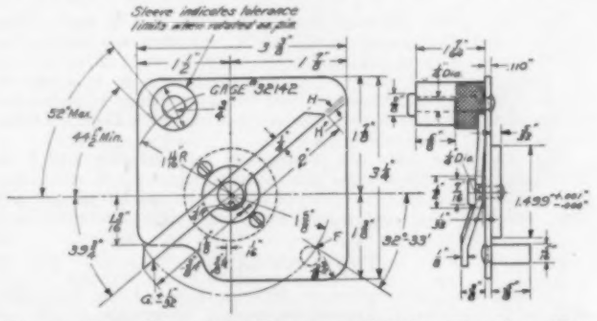


Fig. 9—Gage No. 32142 Recommended for Checking New Hose Couplings

the interchange rules providing that all cars built after a date to be specified by the Arbitration Committee must be equipped with centrifugal dirt collectors.

The Arbitration Committee has referred this subject to this committee with a suggestion that if we considered it desirable to require the application of dirt collectors on new cars, we should recommend a specific date in this report. We would, therefore, recommend as follows:

"All cars built on or after June 1, 1929, must be equipped with centrifugal dirt collectors.

Cleaning, Lubricating and Testing Air Brakes on Passenger Cars—To provide for operating conditions which in some cases necessitate the cleaning of brake equipment in less than 12-month periods, we would recommend that A. R. A. Rule 1 of the passenger-car code be changed to read as follows:

Rule No. 1: Each railway company shall give to foreign cars, while on its line, the same care as to inspection, oiling, packing and the cleaning, lubricating, testing and adjustment of brakes that it gives to its own cars, except in case of cars on which work is done under special agreement existing between the company owning the cars and the road operating same.

The report was signed by G. H. Wood (chairman), supervisor of air brakes, Atchison, Topeka & Santa Fe; T. L. Burton, air brake engineer, New York Central; B. P. Flory, superintendent motive power, New York, Ontario & Western; J. M. Henry, assistant chief of motive power, Pennsylvania; W. J. O'Neill, general mechanical superintendent, Denver & Rio Grande Western; W. H. Clegg, chief inspector air brake and car heating equipment, Canadian National; Mark Purcell, general air brake inspector, Northern Pacific; R. B. Rasbridge, superintendent car department, Reading; G. E. Terwilliger, supervisor of auxiliary equipment, New York, New Haven & Hartford; M. A. Kinney, superintendent motive power, Hocking Valley; and H. A. Clark, general air brake inspector, Minneapolis, St. Paul & Sault Ste. Marie.

In presenting this report, Mr. Wood made the following comment preceding the section on cleaning, lubricating and testing air brakes on passenger equipment cars:

"The member that requested this recommendation has withdrawn the recommendation for the present, so we will not submit it at this time."

Discussion

Chairman Smart: I want to draw your attention again to the difference in the range of the braking ratio of the truck, 410 per cent. You men that have to handle and repair trucks know what it means when you get cars on to your tracks with such a variation of levers. If we can get down to the standard we will have to keep a far less number of parts to make repairs to the brake rigging. Levers, bottom rods and so forth are the parts that require considerable repair work.

Mr. Brazier: I move that the report be accepted and that the parts required be referred to letter ballot.

(*The motion was seconded and carried.*)

Report of Committee on Couplers and Draft Gears

R. L. Kleine
Chairman

In our report submitted to the 1927 convention a description was given of the draft-gear testing laboratory and of the organization for conducting the tests.

The draft gears being tested are what may be termed the standard freight gear of the manufacturer. In each case the manufacturer was requested to submit full information covering all draft gears intended for use in the standard 24⅝-in. pocket, together with his recommendations as to which type of gear should be tested and these recommendations were carefully considered when deciding upon the design or type of gear.

Draft gears from the following manufacturers are included in the tests as now arranged for:

National Malleable & Steel Castings Co.	Standard Coupler Co.
The Bradford Corp.	W. H. Miner, Inc.
Westinghouse Draft Gear Co.	Keyoke Railway Equipment Co.
Waugh Equipment Co.	Edgewater Steel Co.
Hall Draft Gear Corp.	Union Draft Gear Co.

Ten draft gears of each design are subjected to test. The capacity and characteristics of eight are obtained under the 27,000-lb. tup and of two under the 9,000-lb. tup. Five of the ten gears are then subjected to the endurance or wearing-out test and five to the sturdiness test, the latter being to show the ability of the gear to withstand over-solid blows. The 27,000-lb. tup is used in these two tests.

The draft gear tests are progressing satisfactorily, and it is anticipated that, unless some gear develop unexpected endurance, the actual testing should be completed by the end of the present year, which is somewhat earlier than was originally expected.

Top Lock Lifts

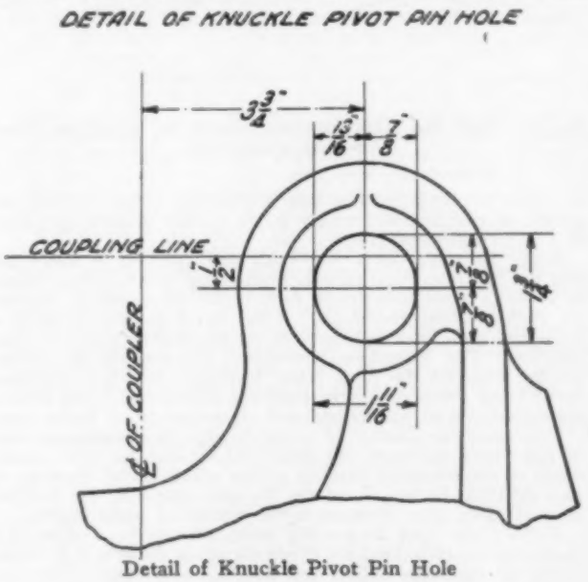
To facilitate identification in service of No. 2 top lock lifts and upon recommendations made to your committee, the secretary has been requested to change Fig. 7-A, section "A," page 47, of the Manual to show the numeral "2" located near the top of the lifter, also on both sides instead of on one side only as at present.

Pivot Pin Hole in "D" Coupler

The Manual does not show the dimensions of the pivot pin hole in the coupler body and the fact that this hole is elongated and not round has resulted in some misunderstandings and controversy with the coupler manufacturers.

In order to make the situation clear, the Secretary has been requested to insert a drawing on page 62, section "A," of the Manual, showing the dimensions of the hole, which are 1¾ in. by 1 11/16 in., the larger dimensions being parallel with the coupler shank.

The report was signed by R. L. Kleine (chairman), assistant chief of motive power, Pennsylvania; C. P. Van Gundy, engineer of tests, Baltimore & Ohio; C. J. Scudder, superintendent motive power and equipment, Delaware, Lackawanna & Western; H. W. Coddington, engineer of tests, Norfolk & Western; C. B. Young, consulting mechanical engineer, Chicago, Burlington & Quincy; Samuel Lynn, superintendent rolling stock, Pittsburgh & Lake Erie; L. P. Michael, mechanical engineer, Chicago & North Western; E. A. Gilbert, general master car repairer, Southern Pacific; and M. A. Hall, superintendent of machinery, Kansas City Southern.



Detail of Knuckle Pivot Pin Hole

Report on Purdue Draft Gear Tests

By William E. Gray
Purdue University, Lafayette, Ind.

For the purpose of securing definite data upon which to base specifications for the purchasing of railway draft gears, the Purdue Engineering Experiment Station has been co-operating with the A. R. A. Committee on Couplers and Draft Gears since the summer of 1926. During this time there has been erected at Purdue University a draft gear testing laboratory in which several types of draft gears have been tested up to date. The details of this procedure will be briefly explained.

The first step in such a program was logically the securing of complete and absolutely comparable tests of present day draft gears from some unbiased source. Numerous draft gear tests had been previously made, but there was in many cases one reason or another why they did not meet the above requirements. One person will test draft gears one way and another person will test them in a different way. Both methods may be satisfactory, but the results are not comparable. Then there is a

wide variation in the equipment on the different draft gear testing machines throughout the country, which makes the results secured unsatisfactory from the foregoing standpoints.

It was the task of your committee to procure a testing machine, provide suitable quarters for it, work out a satisfactory test method, and secure test data. The machine and the test method will be described in detail later. Each manufacturer whose draft gear is in regular use in freight car service was asked to designate which of his gears he desired to be tested as representing his most recent product. Only one type from each manufacturer was considered, as draft gear tests are necessarily long drawn out affairs and it was not desired to spend too much time getting test data before proceeding with the further details of the program. To date there have been selected for test ten different makes of draft gears, and studies are being conducted on ten gears of each make. It is the expectation of the committee to have these tests completed and the recommended specifications ready for presentation at the next convention of your Association.

Description of Plant

The draft gear testing machine was specially designed and built for this work, and nothing was spared to make it the most up-to-date machine in existence. It was equipped with a 27,000-lb. tup in order that the average velocity of impact when closing the average gear would be more nearly that which occurs when gears are closed in car impacts. In order to secure results which could be compared with draft gear tests previously made, the machine was also equipped with a 9,000-lb. tup, as practically all tests made elsewhere have been made with this size tup.

The foundation on which this machine rests is especially rigid. The base of the machine is a solid piece of steel weighing 50,000 lb., measuring approximately 6 ft. by 8 ft. by 27 in. thick. It rests upon a concrete foundation which goes down into the ground 21 feet. This foundation is 16 ft. square at the bottom and 12 ft. square at the top, having a computed weight of 500,000 lb. The base of the machine was set on this foundation while the top layer was still wet, so as to secure a perfect bond.

The machine may be operated either manually or automatically. Manual operation is used for setting datum lines, and when using the tup as a press to open and close gears, etc. The testing blows are delivered with automatic operation. In using automatic operation, the machine is set for the desired height of drop, with the tup in position about ⅛ in. above the gear. The operator starts the machine and the blow is delivered from the correct height, the machine continuing in motion until it has picked the tup up again and stopping in the original starting position. If desired, the machine will set itself during this cycle for the next blow which will be at a higher height of drop. The advantage of this arrangement in promoting the speed of testing is obvious.

There are a number of auxiliary devices on the machine which are designed to give complete and accurate information. The height of every blow is measured by a slide which works on a steel scale graduated in hundredths of an inch. The closure of the gear is measured by two specially designed closure gages mounted on either side of the gear, rigidly supported on the standards of the machine. After each blow these gages are reset in order to detect any smaller closure which may occur even though the height of drop is increased. On the tup is mounted an impact dynamometer which measures the cushioning value of the draft gear. There is also provided a high-speed chronograph which gives information as to the behavior of the tup during the draft gear cycle, from which may be obtained the characteristics of the draft gear.

This chronograph is supported entirely independent of the machine to eliminate the effects of vibration caused by the impact of the tup on the gear. It is designed so that two different drum speeds may be used to take care of the wide range of striking velocities encountered in using tups of two different weights. The drum is driven by a synchronous motor, the speed of which depends solely upon the frequency of the current used. In order to obtain the exact speed at every blow a frequency meter is provided. A special clamp insures a positive connection between the chronograph rod and the tup, thereby insuring a faithful reproduction of the tup motion on the chronograph card. These chronograph cards are drawn on sensitized paper with a bronze stylus, which gives a fine line throughout the entire card. Fine lines are necessary for accuracy in detecting any slight irregularities of gear action.

Course of a Gear Throughout the Test

In order to secure representative commercial gears they are purchased from the stock of some railroad company or car builder. Before shipment is made these gears are checked against drawings furnished by the manufacturer, which show the type of gear he designated at his most representative gear for freight service. They are shipped to the laboratory in boxes made of dry, well-seasoned lumber not less than 1½ in. thick. Oak lumber is not used for these boxes on account of its hygroscopic properties. The boxes are securely banded around each end. A record of all identifying marks on the gears is forwarded to the laboratory for checking purposes.

In the laboratory each gear is taken apart and a detailed record of measurements of all parts made, which is compared with the manufacturer's blueprints. The parts are marked so that the gear is always reassembled in the same manner. Particular attention is paid to such things as assembled and free heights, clearances, possible travel, weights of parts, spring compression, etc. The springs are given a static test in order to compute the forces which they set up in the gear.

In setting up the gears for test, an effort is made to duplicate service conditions as closely as possible. The gear is placed in a test pocket which is made up to represent the draft gear pocket in a freight car. It is of standard length, has top and bottom lugs confining the gear which correspond to the front and rear stop lugs on a car, the regular complement of followers is used as in service, and the blow is delivered through a plunger which is the same size as the butt of the standard type D coupler. With this equipment the blows will be delivered to the gear the same way as in service. Since regulation followers have a certain variation in thickness due to manufacturing methods, and since this variation affects the travel of the gear, only followers are used which were more than the standard 2¼ in. in thickness and were machined off on one side to give correct thickness. The unmachined side is placed next to the gear. Thus is eliminated this variable without getting away from service conditions.

To secure absolutely comparable results every gear is tested according to the same standard procedure. Each gear is first given a preliminary test in which its capacity is determined. The 9,000-lb. tup is used for two of the ten gears and the 27,000-lb. tup for the other eight. The gear is then given a test to condition it, which consists of 10 blows from a height just under the closing height. Then the test to establish its official capacity is made, in which a chronograph card is made for every blow. No gear is ever given more than 100,000 ft. lb. of work in any one hour on any test, in order to prevent heating of the friction surfaces, which does not occur in service. At this point the gears are taken out for a detailed inspection, which gives opportunity to observe how the parts of the gear are standing up and how the friction surfaces are acting.

Five of the ten gears are then put on the sturdiness test, and the other five are put on the endurance test, all of this testing being done with the 27,000-lb. tup. The sturdiness test is designed to show the ability of the gear to withstand oversolid blows. These blows are delivered in cycles of 10 blows at a given height of drop, each cycle being followed by a capacity determination and a detailed inspection. The height of drop for each cycle is increased ½ in. above that for the preceding cycle. The endurance test is intended to show the wearing qualities of a gear. The blows, all of which are below the closing height of the gear, are delivered according to an arrangement whereby most of them are at smaller heights of drop. This arrangement, which is known as the pyramiding cycle, is one blow at 1 in., then one at 1 in., one at 1¼ in., then one at 1 in., one at 1¼ in., one at 1½ in., and so on, continuing up to within ½ in. of the closing height, when the cycle is started all over. This cycle has been adopted to represent road service conditions, in which a gear gets comparatively few heavy shocks and a relatively large number of lighter blows of varying intensity. After each two million foot pounds of energy has been delivered to the gear it is given a capacity determination and is taken apart for a detailed inspection. These tests are continued until the gear is no longer serviceable.

Results Secured from Tests

In addition to the direct determinations of capacity, sturdiness and endurance of these gears, data is secured from which may be worked up a great deal of other information. Every time the gear comes under the hammer the height of the tup above the anvil with the tup in datum position is noted. This gives information from which may be computed the coupler horn clearance were the gear in service. Every time the gear is put in the testing pocket there is noted the amount of compression under which the gear is placed. This will tell whether the gear is tight or loose in the pocket. From the capacity determinations may be plotted closure curves, which are an indication as to whether the gear is a hard one or a soft one. The cards from the impact dynamometer give a measurement of the cushioning value of the gear. The chronograph cards show the recoil of the gear and may be worked up to show the force which the gear exerts throughout the entire cycle of gear action. The periodical inspections gives information as to how failures develop, and how the different metals wear in service.

For working up the chronograph cards use is made of a mechanical differentiator, of the type designed by Armin Elmen-

dorf, formerly professor in the University of Wisconsin. After several changes in the construction wonderful results have been secured with this instrument. It will show the force with which the draft gear starts out, the maximum force which it exerts, and the way in which this force is built up. One of the great problems in draft gear testing has been the procuring of just this information, because these forces do not last long enough to obtain any direct measurement of them.

When this series of tests is finished there will be at hand complete information as to the action of modern draft gears, and this information will be comparable for all gears in so far as laboratory tests can show. Both the desirable and undesirable characteristics will be known, and this information can be used as a guide for writing specifications for a satisfactory draft gear. The tests have aroused a great deal of interest among manufacturers of draft gears, and already several of them have applied for the use of the laboratory for making tests of their own as soon as it is available for this purpose. Your committee feels that the most modern testing equipment which has been assembled here will be of great value in stimulating draft gear development by enabling those engaged in this business to learn some things about their gears which it was formerly impossible for them to find out. It is hoped that this beginning which has been made in the solving of the problem of providing the best possible draft gears for railway service will eventually lead to a situation satisfactory to all parties concerned.

In behalf of Purdue University, Dean A. A. Potter joins me in expressing to you our appreciation for the encouragement which we are receiving from you in carrying out our part of the program.

Discussion

Mr. Brazier: I move that the report be accepted, the committee be continued, and a vote of thanks be given the committee by this convention.

(*The motion was seconded and carried.*)

(The meeting adjourned.)

Registration, A. R. A.

Continued from Page 1490D102

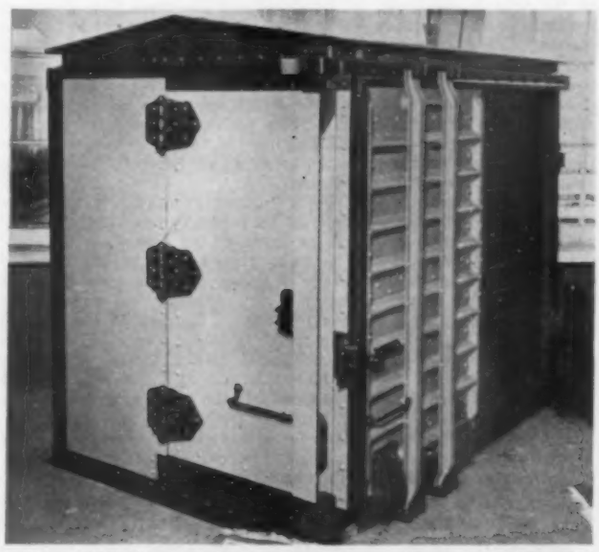
Geo. Saib, Pennhurst
J. E. Saunders, Sig. Eng., D. L. & W.
John R .Savage, Car Insp., Reading
Emanuel Schaeffer, Asst. R. F., Reading
J. A. Schwenck, Asst. For., Reading Elberon
L. D. Shapiro, Car Acct., E. J. R. R. & T., Brighton
E. S. Shepard, Shop Insp., B. & O.
J. L. Sherwood, Car Rep. Acct., B. & O., Knickerbocker
G. F. Shull, S. M. P., Clinchfield, Marlborough
Geo. H. Sinks, Trav. Pass. Agt., B. & O., Chelsea
J. T. Smith, P. R. R.
Ralph H. Smith, Machinist, Reading, Shoreham
J. L. Snyder, Y. M., P. R. R., Thompson
C. H. Springmam, Asst. For. R. H., P. R. R., Strand
H. W. Staples, Stewart to R. C. Vaughan, Can. Nat.
J. Oliver Steiger, Asst. Train Mst., Reading
Fred H. Stigale, For. Tinsmith, Penna.
S. Stock, Joint Elev. For., N. Y. C., Craig Hall
E. G. Storck, Master Carp., Reading
I. M. Susser, Pennhurst
F. B. Sutherland, M. P. Insp., P. R. R.
John H. Tanger, Draft., Sou.
C. H. Thomas, Mat. Insp., C. & N. W.
Jos. W. Todd, Ch. Clk. to V. P., P. R. R.
Robert Tonkin, Insp. Saf. App., U. S. Gov., Princess
T. Toshi, Manager, S. Manchuria, Chelsea
Major J. N. Thomas, Pub. Dept., Penna., Elberon
J. M. Tynan, Draftsman, N. Y. C., Traymore
L. Van Otten, Insp., N. Y. C., Acree
Arthur Voorhees, Engr. Opr. Dept., C. R. R. of N. J., Morton
Frank Wall, Asst. V. P., N. Y., N. H. & H., Chalfonte
Oliver H. Walton, Reading, Monticello
F. N. Wardell, Asst. Eng., N. Y. C., Haddon Hall
H. J. Warthen, Jr., Marlborough
W. W. Weeks, Pass. Cond., Penna., 9 N. Conn. Ave.
H. L. Weinberg, Elec. Insp., N. Y. C., Traymore
A. Weir, Asst. to Elec. Eng., N. Y. C.
H. Cleveland Wellman, Ch. Cl. N. Y. C., Flanders
G. W. Wentzel, Asst. For., Reading
R. C. Whiteman, Mech. Insp., B. & O.
E. L. Wigglesworth, Supr. Paint., C. & O., Dennis
D. T. Williams, Llewellyn
J. P. Williams, Insp. Pass. Trans., P. R. R.
Jos. Williams, Ritz-Carlton
A. R. Wilson, Eng. Bdg. & Bldgs., Penna., Chalfonte
Chas. B. Wingate, Asst. Eng. Val., Reading
N. Winigradoff, For. Mech. Dept., D. L. & W.
Marion J. Wise (Mr.), Asst. to V. Chair., S. P., Traymore
Geo. Wolfard, For., C. C. C. & St. L., Princeton
C. E. Woodworth, Service Agt., I. C. C., Chalfonte
Mr. Wu Cheo Chu
Donald M. Yest, Asst. Supvr. Trk., Reading
A. H. Yocum, Sig. Eng., Reading
A. W. Yoder, Boiler Insp., Reading
Clarence W. Young, Dir. of Aeronautics, Dept. of Comm.
H. T. Young, Gen. Agt., Erie, Chalfonte

New Devices

All-Purpose House Car

AN all-purpose house car with diagonally disposed corner entrances, in addition to the usual side doors, is being developed by the Camel Sales Company, Chicago, and a car-end equipped with one of these corner entrances is being exhibited by the Camel Company. This diagonal entrance is composed of a side door and half end door, their front edges meeting and overlapping one another. The side door slides in the usual manner and the end door hinges. A substantial swinging corner post is carried by the end door which, when locked, effectively replaces the end post.

House Car Entrance Open



Camel All-Purpose House Car Corner Entrance, Closed

With this type of construction, half of the end may be maintained as solid end structure, lending greater strength than is had with house cars having 10-ft. or

12-ft. side doors and end doors. The corner side door is wood, lined and braced against thrust, so that the load may be placed against it without the use of grain doors or excessive coopering. Either door may be opened independently of the other, being locked and sealed, however, by a single lock.

This type of car end, lending itself to flexibility in door opening, is designed to incorporate the following advantages: Facilitates the loading of automobiles from side platforms; facilitates the loading of automobiles from side platforms under their own power, eliminating a flat car as a platform of approach; greatly facilitates the loading and unloading of less-than-carload shipments by presenting two additional entrances and exits to the car; always presents an entrance from a side platform, eliminating spotting; provides an excellent car for the transportation of lumber, shafting and other bulky lading too large to be admitted through the ordinary 10-ft. side doors; eliminates the necessity of reinforcing the side sill and side plate necessary with 12-ft. side doors, and allows for the maximum strength with the minimum weight.

Lubricated Center-Bearing Bolster

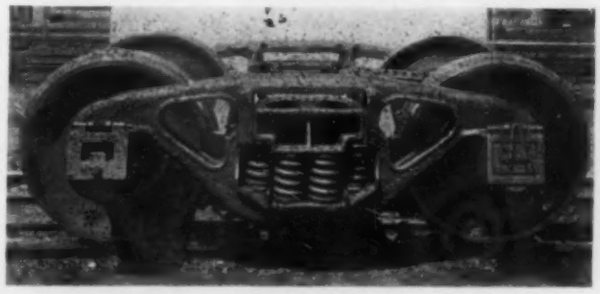
A BOLSTER and center-plate wherein provision has been made for the continuous and adequate lubrication of the center bearing is included in the exhibit of the Pittsburgh Steel Foundry Corporation, Glassport, Pa. The essential features of this construction include a truck bolster member wherein the center bearing recess is made sufficiently deep to retain the corresponding body center plate projection without the necessity for a king pin connection.

The center bearing recess, which is closed at the bottom, forms an oil reservoir. The center plate projection is oiled and is provided with suitably located holes in the bottom and circumference, through which the oil will flow and constantly lubricate all contact members. An oil-tight flexible sealing ring located at the top of the truck center bearing prevents loss of oil and avoids the possibility of any dust or dirt reaching the bearing surfaces.

Truck center bearings are so located that there is every opportunity for the exposure to dirt, grit, sand and flying particles of ballast. In the case of an ordinary center bearing construction, this foreign matter adheres to the grease pressed out between the contact surfaces and forms a gritty, abrasive cake adjacent to the surfaces. The bolster illustrated is so designed that the entrance of grit or foreign matter is completely avoided and, inasmuch as permanent oil lubrication is insured, both friction and wear are largely eliminated.

Roller-Bearing Truck

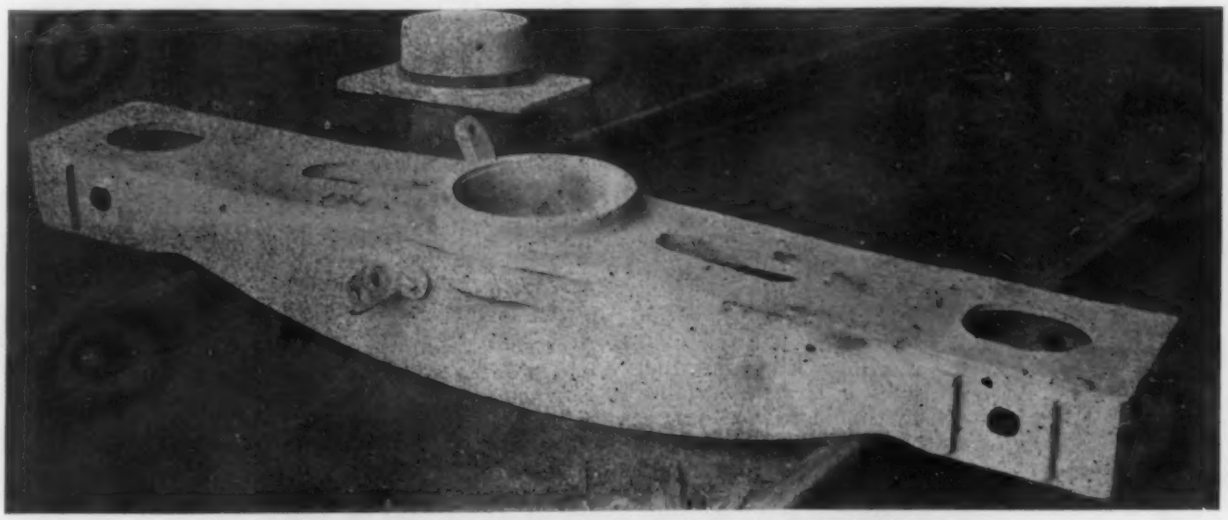
ONE of the impressive exhibits at the convention this year is that of the roller-bearing truck at the American Steel Foundries Booth 149-150. This truck, featured by the application of self-contained roller bearings within the wheel structures, is mounted on a short and carefully-leveled track section, with a slight incline at either end, the almost complete absence of



Newly Developed American Steel Foundries Roller Bearing Truck

friction being indicated by the fact that the 8,000-lb. truck, once started, runs back and forth on the track section for several minutes before requiring an additional start.

This truck design provides a pair of wheels and axles self-contained with roller bearings, interchangeable as an assembly with the A. R. A. standard wheel and axle assembly. The wheels are mounted by pressed fit on a tubular housing which revolves around a stationary axle on a roller bearing at each end. The inner stationary axle is carried in the usual standard journal box at each end, the bearing and wedge being used in the



Pittsburgh Lubricated Bolster Center Bearing and Body Center Plate

same manner as with the standard railroad axle. In normal operation only the roller bearings function, as the axle does not rotate.

This method of mounting roller bearings permits the use of any of the various types of bearings which have been developed for railroad service. Experiments so far made have been with the Timken and Shafer bearings. The general scheme of mounting the outer race in each end of the tubular revolving hub and the inner race on each end of the stationary axle, with considerable space between the two bearings, is in conformity with successful applications of roller bearings designed to prevent any possibility of the bearing being pinched or unevenly loaded by distortions of the truck on uneven and curved track.

The stationary axle transmits the weight of the car from the journal boxes to the roller bearings and is, therefore, subjected to forces similar to those to which the A. R. A. type is subjected under vertical load.

The wheels for this assembly have about double the hub bore of the standard A. R. A. wheels and, as a result, flange pressures have less leverage in producing stresses affecting the fit of the wheel on the axle, and the area of the wheel fit is increased. This wheel weighs from 75 to 150 lb. less than wheels of the same capacity fitting the A. R. A. standard axle.

Tests of the new A. S. F. roller-bearing truck have been conducted in a special machine which approximates service conditions. The units tested were full size and of the exact design proposed for railroad service, two complete units being tested at one time, one supported above the other with the wheel treads held together by a heavy spring. In addition to the laboratory tests, one passenger car has been equipped with these roller-bearing wheel and axle units, and is now in regular passenger service out of Chicago daily.

The test data secured and a survey of the general roller bearing situation are said to indicate that this application for passenger cars, tenders or freight cars will reduce starting resistance to one-eighth of that of plain bearings, reduce rolling resistance from 5 to 12 per cent at all speeds, save fuel, increase speeds, permit increasing tonnage ratings and result in numerous other advantages incidental to the application of roller bearings.

Generator Shock Absorbers

A SHOCK absorber for application to car lighting generators is being exhibited by the National Railway Appliance Company, New York. When in service it is connected between the car lighting generator and the car body and serves to dampen sudden swings of the generator. Such swings, caused by coupling and slack action, are probably responsible for the loss of many car lighting belts, because they strain the belt fastener.

The shock absorber consists of a cylindrical housing, separated into two parts by fins or walls, in which are two movable fins, connected to the movable shock absorber arm. The housing is filled with a glycerin-alcohol solution and movement of the arm serves to force the solution through small apertures from one compartment to another. The size of the aperture can be adjusted and the speed of movement governed accordingly. Provision is made for allowing any air inclusions in the liquid to escape, and a reservoir keeps the operating compartments constantly filled with liquid. The device is remarkable for the precision with which its various parts are made.

Hollow Staybolt Stock in Long Bars

THE Falls Hollow Staybolt Company, Cuyahoga Falls, Ohio, which is exhibiting hollow staybolt stock, has effected developments in shop equipment and processes which make possible the production of hollow bar stock in lengths of 15 ft. and over. This improvement has been made to permit the fabrication of water space, crown and long radial stays from these lengths with less waste of crop ends. These long bars are said to be produced with a satisfactory minimum of variation of the hole from the center of the bar.

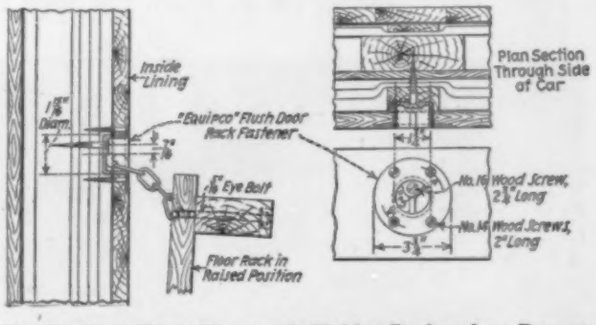
Saniservis Towel-Vending Machine

THE West Disinfecting Company, New York, is exhibiting a new towel-vending machine which has recently been developed for distributing paper towels in public washrooms. It has been developed to fill the demand for a machine, the revenue from which will make possible a much better service of this class than is the case where such service is rendered free of charge. This development is known as the Saniservis paper towel penny vending machine, and while it is a quite recent development, it has already demonstrated, in service tests on a large railroad system, that it is able to render a more satisfactory service to patrons and return a substantial profit to the railroad company.

The machine itself is ruggedly constructed, having a steel cabinet with the coin-actuating mechanism and an indicator to show the unused content of the machine. By an ingenious application of a magnet, a means is provided by which slugs of magnetic material will prevent the machine from functioning.

Equipco Floor-rack Holder

A floor-rack holder which is flush with the inside lining to prevent chafing, marring or tearing of packages in transit, has been developed and is being exhibited by the Equipment Specialties Company, 310


Inside Lining
"Equipco" Flush Door Rack Fastener
Eye Bolt
Floor Rack in Raised Position
Plan Section Through Side of Car
No. 16 Wood Screw, 2½" Long
No. 16 Wood Screws, 2" Long
3½"

The Equipco Flush Floor-rack Holder Designed to Prevent Damage to Packages in Transit

South Michigan avenue, Chicago. The holder consists of a malleable casting set in the side lining and an eye bolt and chain attached to the floor rack. The end link of the chain loops over a hook in the wall casting and furnishes a flexible fastening. It also prevents the fastening from chafing or marring packages. The casting is easily applied to the side lining by using a special cutter shaped after the general contour of the casting.

W